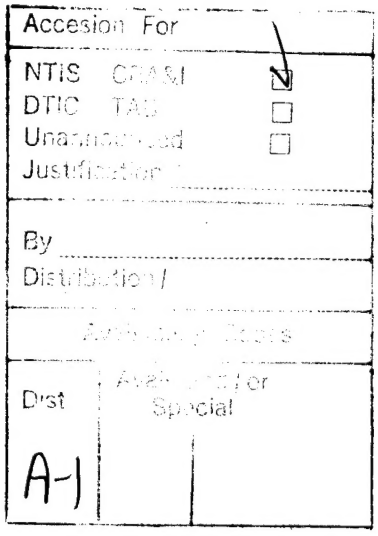
NSWCDD/MP-93/85
AEGIS DOCUMENT-93/1

AEGIS SOFTWARE ENGINEERING PROCESS DOCUMENT

BY SOFTWARE ENGINEERING PROCESS GROUP
AEGIS PROGRAM OFFICE
COMBAT SYSTEMS DEPARTMENT



AUGUST 1993

CHANGE 3 - 27 March 1995

NAVAL SURFACE WARFARE CENTER
DAHLGREN DIVISION
Dahlgren, Virginia 22448-5000

LIST OF EFFECTIVE PAGES

Insert latest change pages in accordance with the cover letter instructions. NOTE: On a change page, the portion of the text affected by the latest technical change is indicated by a vertical line in the outer margin of the page. The High-Level Design Phase, however, does not follow this convention because it is an entirely new section.

Original (Change 0) . . . August 1993
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FOREWORD TO CHANGE 3

Many changes have taken place in the AEGIS software engineering process improvement arena since the original document was published. They have been documented in year-end reports.[1]

Current SEPG members are Edward J. Dudash, Chairperson, N20P; John R. Maphis, Deputy Chairperson, N20P; Mary Ann Strock, F42; Linda F. George, N81; David E. McConnell, N86; Kenneth M. Novell, N92; Charles B. Graham and Charles H. Sperry, Computer Sciences Corporation; and Paul B. Garnett and Larry K. Walker, LOGICON, Syscon Corporation.

An evaluation of the most efficient way to use the limited resources available to AEGIS led to the dissolution of the Software Engineering Process Committee on 10 March 1995.[2] The role of that organization has been absorbed by other groups functioning as action teams.

Change 3 was prepared by Mr. McConnell and Mr. Sperry. It was reviewed on 13 March 1995 by representatives from the NSWCDD AEGIS Organizations.

During the time span over which this document was prepared, some organizations changed their names; e.g., Lockheed Martin (formerly Martin Marietta Corporation) and System Test and Evaluation (formerly Integration) Branch. The SEPG believes that the level of understanding enjoyed by SEPD users does not require that these changes be implemented throughout the document; therefore, they are postponed to some future revision.

Approved by:

Edward J. Dudash
EDWARD J. DUDASH
Chairperson, Software Engineering
Process Group

James D. Robinson
JAMES D. ROBINSON
Assistant Program Manager
for Computer Program
Engineering

Authorized by

Reuben S. Pitts III
REUBEN S. PITTS III
Head, AEGIS Program Office

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[1] For 1993, AEGIS Document-94/01, and for 1994, AEGIS Document-95/06.

[2] N20P Memo Subj: Software Engineering Process Committee, dtd 10 Mar 94.

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31 May 1995

To all holders of NSWCDD/MP-93/85 (AEGIS Document-93/1)

Subject: Change 3 dated 27 March 1995

Title: AEGIS SOFTWARE ENGINEERING PROCESS DOCUMENT, dated August 1993

The subject document is changed to include updates to the AEGIS Software Engineering Process. Remove pages and replace with new pages in accordance with the following instructions. File this letter in the front of the document.

Address questions and requests for additional copies to NSWCDD, Code N20P.

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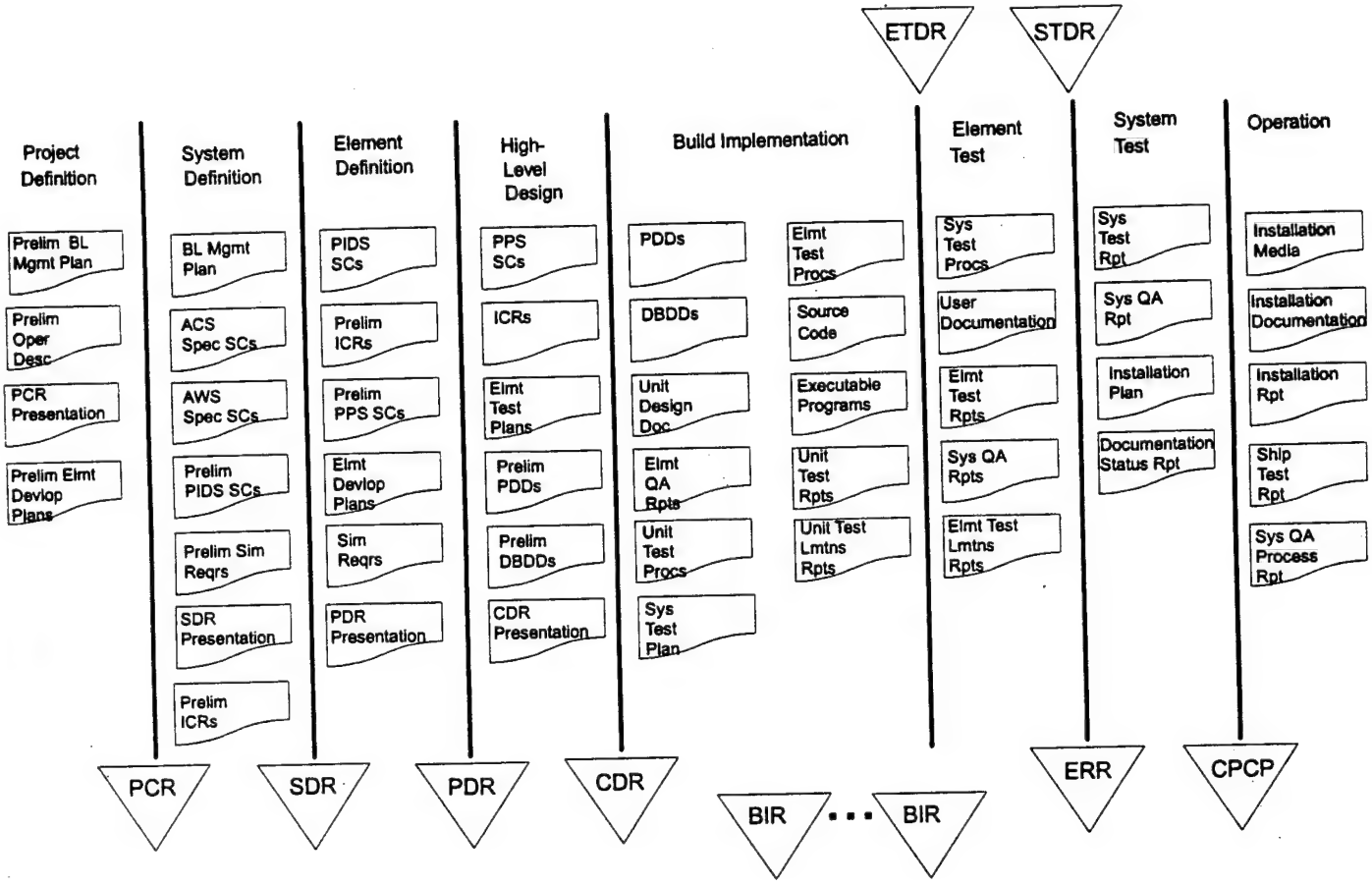

FIGURE I-1. AEGIS WEAPON SYSTEM SOFTWARE ENGINEERING MODEL[1]

[1] Abbreviations are spelled out later in this section.

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System Definition

In the System Definition Phase, analysis is performed to define requirements the system must support and to validate new functional capabilities. System requirements are defined and allocated to elements, and functional interface data are identified. System test and simulation requirements are determined. The conduct of a successful System Design Review (SDR), marked by PMS400B authorization to proceed, closes this phase. This review is an assessment of the completeness of system design, and a review of the allocation of requirements from the standpoint of optimization, traceability, correlation, completeness, consistency, and risk. Authorization to proceed denotes approval of the system engineering aspects as well as programmatic scope, schedule, and resource requirements.

Element Definition

In the Element Definition Phase, all system requirements allocated to the elements are fully analyzed, and computer program performance specifications and interface design specifications are developed; elements prepare element development plans. Training, logistics, simulator, and simulation requirements are defined. A Preliminary Design Review (PDR) is held where progress, plans, and allocation of requirements are reviewed and validated by PMS400B and authorization to proceed is given.

High-Level Design

In the High-Level Design Phase, the physical architecture and high-level design of the computer programs are developed and documented. Requirements are allocated to modules, common data, and intermodule interfaces. Design is formulated by representing the impacts upon procedural interfaces in terms of data flow, control flow, procedural hierarchy, and data structure. Approval is obtained for non-Mk7 interfaces. Program performance and interface design specifications are prepared for a Critical Design Review (CDR), where preliminary data base and program design documentation are also presented for PMS400B approval. Authorization to proceed indicates the physical architecture and high-level design meet requirements, design documentation is valid and sufficient to guide detailed design, and the interface working groups have approved interface requirements.

Build Implementation Phase

In the Build Implementation Phase, each unit identified during the High-Level Design Phase is developed and checked out. Depending on the nature of the computer program change requests (CPCRs), the changes to the computer program may or may not merit test procedure generation; but all changes are designed, coded, and unit tested. At the conclusion of each build, a Build Implementation Review (BIR) is conducted and the results of all build activities are discussed. The BIR for the final build summarizes the disclosures of the previous BIRs, and serves as the control event that signals the end of the Build Implementation Phase. The report documenting the

final BIR is the control event that ensures completeness of all code and unit testing activities and serves as a status report for Baseline Management.

Element Test

The Element Test Phase begins with a control event, Element Test Disclosure Review (ETDR), where element test planning, test design, and test procedure documentation are reviewed for completeness and the readiness of ACSIS required simulators and support computer programs is determined. Following authorization to proceed, the elements conduct multi-element integration and testing, stress and regression testing, and validation of all interface design specification (IDS), prime item development specification (PIDS), and computer program performance specification (PPS) changes. During this time period, user documentation and system test procedures are prepared. Completion of the control event, Element Readiness Review (ERR), certifies that element development is essentially complete and that the computer programs are ready for the System Test Phase.

System Test

The System Test Phase begins with a control event, System Test Disclosure Review (STDR), where System Test and Integration discloses its test plan, test design, etc. Testing is conducted for regression, stress, and combat system integration; and tests and test observation reports are analyzed. Concurrently, all ACS and AWS changes are validated. The phase ends with the convening of a Computer Program Certification Panel (CPCP) and Program Office (N05) decision as to the program's and its documentation's readiness for installation in the fleet and at shore activities.

Operation

In the Operation Phase, computer programs and documentation (both AWS and non-Mk7) are installed on board ship and tested, and crew training and user support is conducted, including crew indoctrination. The installation is reviewed with the ship's Commanding Officer, Combat System Officer, or System Test Officer. Problem reports are investigated and resolved. NSWCDD continues to provide each ship with this kind of support for baseline upgrade installations and in response to CPCRs.

Management Support

Management support is not a separate phase in that it is bounded by control events; rather its activities range throughout the entire life cycle. It is a convenience for grouping non-phase-specific activities as personnel management, configuration management, quality assurance, software engineering process improvement, metrics, and management administration.

AEGIS ORGANIZATIONS

AEGIS Organizations are all the participants in the NSWCDD AEGIS software engineering process. They are named as performers or participants in the activities discussed in detail in each phase.

Sponsor

AEGIS Program Manager[1]	PMS400
ACS Change Control Board	CCB
Interface Control Working Group	ICWG
Warfare Commanders	PMS400
Director, Technical Division	PMS400B
Technical Director	PMS400B
AEGIS Combat System Engineer	PMS400B3
AEGIS Baseline Manager	PMS400B32
Director, Fleet Introduction Division	PMS400F
Destroyer Acquisition	PMS400D
System Acquisition	PMS400G
Technical Representative	PMS400N

Development Agent

Martin Marietta Corporation, Government Electronics Systems (Formerly Government Electronic Systems Division (GESD))

Software Implementation Board — SIB

Defense Plant Representative Offices — DPRO

Engineering, Test, and Support Organizations

Applied Physics Laboratory, Johns Hopkins University — APL

[1]In this document, Program Manager refers to PMS400; Program Office, NSWCDD N05.

Combat System Engineering Development Site	CSEDS
AEGIS Combat Systems Center	ACSC
AEGIS Training Support Group	ATSG
AEGIS Test Team, Pascagoula	ATT/P
AEGIS Test Team, Bath	ATT/B

AEGIS In-Service Engineering Agent

Port Hueneme Division, Naval Surface Warfare Center	PHDNSWC

AEGIS Ship Personnel --

NSWCDD Organizations

Information Security	C9
SPY Radar System	F42
AEGIS Data Center	E231
Combat Systems Department	N
AEGIS Program Office, Program Office Core Team	N05
LSEA Configuration Control Board (CCB)	N05
Assistant Program Manager for Life Support Engineering	N054
Assistant Program Manager for Computer Program Engineering	N055
Combat Systems Engineering	N20
Baseline Manager, Baseline Management	N20B
Software CM Manager	N20C
AWS Change Review Board	N20C
Software Engineering Process Group	N20P
Systems Control and Operational Support	N21
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Documentation Management	N21
Fleet Support	N21
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Computer Systems	N86
AEGIS Computer Center	N86

AEGIS Tape Library	N86
Program Generation	N86
AWS Change Review Board Configuration Management	N87
Combat System Configuration Management	N87
Warfare Control	N90
Combat Direction Systems	N91
Command and Decision	N91
AEGIS Display System	N91
AEGIS Weapons and Fire Control	N92
Fire Control System	N92
Weapon Control System	N92
Element, Elements	
Branch Heads	

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LIST OF ABBREVIATIONS

ABAM--AEGIS Weapon System Computer Program Baseline/Document Applicability Matrix
ACC--AEGIS Computer Center
ACCESS--AEGIS Configuration Control and Engineering Status System
ACD--AEGIS Control Document
ACPOT--AEGIS Computer Program Operability Test
ACS--AEGIS Combat System
ACSC--ACS Center
ACSIS--ACS Interface Simulation, Simulator
ACTS--AEGIS Combat Training System
ADAR--AEGIS Data Reduction
ADC--AEGIS Data Center
ADDS--AEGIS Design Description System
ADS--AEGIS Display System
AICR--ACSIS Interface Message Specification Change Request
APO--AEGIS Program Office
ASDS--ACTS Scenario Development System
ASWCS--Anti-Submarine Warfare Control System
ATC--AEGIS Training Command
ATES--AEGIS Tactical Executive System
ATSG--AEGIS Training Support Group
ATT--AEGIS Test Team
ATUS--AEGIS Tactical Utility System
AWS--AEGIS Weapon System
BDF--Baseline Development Folder
BL--Baseline
CAST--Computer Aided Submode Training
C&D--Command & Decision
CCB--Change Control Board
CDD--Configuration Definition Document
CDR--Critical Design Review
CDRL--Contract Data Requirement List
Chg--Change
CLASS--CAST Lesson Authoring System
CM--System Configuration Management Branch
CMI--CM Instruction
CMS--Compiler Monitor System
Concpt--Concept
CP--Computer Program
CPC--CP Change
CPDP--CP Development Plan
CPCP--Computer Program Certification Panel
CPCR--CPC Request
CPDD--CP Description Document
CPM--CP Management
CPQT--CP Qualification Test
CPS--Computer Programming Standard
CPTIP--CP Test & Integration Plan
CPTS--CP Test Site
CRB--Change Review Board
CRECG--Computer Room Error Code Guide

CSC--Computer Sciences Corporation
CSE--CS Element
CSEDS--CS Engineering Development Site
CTR--Code and Test Review
DBDD--Data Base Design Document
DCMAP--Defense Contractor Management Area Operations
DDD--Delivery Description Document, Detailed Design Document
DDCR--Design Document Change Request
DDR--Detailed Design Review
Develop--Development
DID--Data Item Description
DMI--Documentation Management Instruction
Doc/Docs--Document/Documents
DOD-STD--Department of Defense Standard
DPRO--Defense Plant Representative Offices
DXDR--Data Extraction, Data Reduction
EAT--Engineering Analysis Team
ECCB--Element Change Control Board
ECN--Engineering Change Notice
ECP--Engineering Change Proposal
ELMT LDR--Element Leader
Elmt--Element
EQT--Engineering Qualification Test
ERR--Element Readiness Review
ERT--Element Design Review Team
ESOP--Element Standard Operating Procedure
ETDR--Element Test Disclosure Review
FCS--Fire Control System
FDF--Functional Development Folder
FLCR--Film label change request
Func--Functional
GESD--Government Electronic System Division
ICR--Interface Design Specification Change Request
ICWG--Interface Control Working Group
IDS--Interface Design Specification
IMS--Interface Message Specification
IPR--In-Process Review
ISEA--In-Service Engineering Agent
JCL--Job Control Language
LCP--Lesson Control Program
LGEN--Lesson Generator
LGP--Lesson Generator Program
Lmtns--Limitations
LPD--Load Program Description
LPDD--LPD Document
LSEA--Lifetime Support Engineering Agent
MDF--Module Development Folder
MEIT PM--MEIT Pack Management
MEIT--Multi-Element Test & Integration
Mgmt--Management
Mgr--Manager
MPS--Master Program Save
MTASS--Machine Transferable Support Software
NSWCDD--Naval Surface Warfare Center Dahlgren Division
OCP--Operational Computer Program
Op, Oper--Operational

OPNAV--Office of the Chief of Naval Operations
OPP--Operating Principles and Procedures
Org--Organization, Organizations
ORTS--Operational Readiness Test System
PCR--Project Commitment Review
PD--Publication Directive
PDD--Program Design Document
PDR--Preliminary Design Review
PDS--Program Design Specification
PGE--Program Generation Environment
Pgms--Programs
PHDNSWC--Port Hueneme Division, Naval Surface Warfare Center
PIDS--Prime Item Development Specification
PMA--Post-Mission Analyzer
PMO--Project Management Office
PMS400--AEGIS Program Manager
POA&M--Plan of Action & Milestones
POM--Program Objectives Memorandum
PPS--Program Performance Specification
Prel/Prelim--Preliminary
Proc--Procedure
QA--Quality Assurance
QAI--QA Instruction
QAP--QA Procedure
QRG--Quick Reference Guide
Reqrs--Requirements
Rpt/Repts--Report, Reports
SC--Specification Change
SCIB--Ship Characteristics and Improvement Board
SCN--SC Notice
SCP--Support Computer Programs
SDD--Software Design Document
SDR--System Design Review
SIB--Software Implementation Board
Sim--Simulation
SOP--Standard Operating Procedure
Spec--Specification
SRT--System Design Review Team
ST&E--System Test and Evaluation
ST&I--System Test and Integration (previous name of ST&E)
ST&ISOP-ST&I SOP
STCRB--Ship Test Configuration Review Board
STDR--System Test Disclosure Review
STO--System Test Officer
Sys--System
Sys Eng--System Engineering
TCP--Training Control Program
TDS--Tactical Disk Save
TOR--Test Observation Report
TPCR-Test Procedure Change Request
V&V--Verification and Validation
WCS--Weapon Control System
WIP--Warfighting Improvement Plan

USERS' NOTES

This document is under change control and will be updated by change pages as the process evolves.

The data flow diagrams (DFDs) throughout Part II are depicted by EXCELERATOR, an integrated set of analysis and design tools. These diagrams depict application activities, data storage areas, and the movement of information throughout the application. They also represent the control events that determine when processes or phases are complete. For these diagrams, the Gane & Sarson notations were used. Some of the conventions used in the diagrams are listed below. For more information, consult the Chairperson of the SEPG.

- The entire AEGIS Combat System (ACS) is represented by a context diagram which depicts the interfaces between NSWCDD and the external entities (e.g., PMS400, Government Electronic Systems, APL, PHDNSWC).

- The entire AEGIS Weapon System (AWS) process is represented by a diagram that depicts the eight NSWCDD AEGIS software engineering phases, the external control events, and the most significant products of the process.

- Each of the eight phases is represented by a DFD that depicts a number of processes of that phase, in groupings that represent the major activities of the phase, control events occurring during the phase, and key products of the phase, as defined by the process model, and consistent with the AWS diagram.

- Each process is supported by activities, specific actions that are performed.

- Each diagram consists of processes, data stores, data flows, and optionally, external entities.
  - Processes are hierarchically and sequentially numbered; they are actions or events that transform inputs into outputs.
  - Data stores are collections of data that are held for processing.
  - Data flows represent data in motion.
  - External entities are persons or groups with whom the system communicates.

Port Hueneme Division, Naval Surface Warfare Center (PHDNSWC) - Formerly Naval Ship Weapon Systems Engineering Center (NSWSES), In-Service Engineering Agent (ISEA) for CG 47 Class and DDG 51 Class Ship Combat Systems.

Preliminary Operational Description - Document generated by System Engineering in the Project Definition Phase.

Prime Item Development Specification (PIDS) (Type B1) - Specification prepared to practices set forth in MIL-STD-490A. It states the requirements for the design or engineering development of a complex item such as a missile, aircraft, radar set, fire control equipment, etc. PIDSs for components of the AEGIS Weapon System (elements) are maintained by PMS400B.

Print Listing - The sequence of instructions, reports, or other data comprising a computer program output, usually in the form of a human-readable printout.

Program Design Document (PDD) - A document providing a description of the physical architecture of the AWS computer programs, the functional allocation of requirements, and the high-level design of the computer programs. The PDD also includes a specification of the impacted computer program interfaces, and identifies the inter-procedural, inter-module, and module-to-operating system interdependencies.

Project Commitment Review - See Design Review Process.

Process Model - A framework for the activities required to perform software development and support. This framework specifies the inputs and outputs of activities, the sequence and criteria to begin an activity, and the criteria required to complete the activity.

Program Performance Specification (PPS) (Type B5) - A document providing the baseline for subsequent program development. It specifies the operations and functions the element computer program is to perform, and the provisions for quality assurance and testing. The PPS also specifies the appropriate configuration of computer equipment. A PPS specifies performance requirements but not the plan for implementation (e.g.; it does not include the number of builds planned during development). For captured programs, as much original performance documentation as possible is retained to reduce costs. New or modified requirements are specified in change pages to the original documentation. See MIL-STD-1679A.

Publication Directive (PD) - A cover sheet Documentation Management attaches to a specification or an SCN to coordinate the approval process and provide an audit trail.

QA Audit Report (QA Form 006) - A QA form containing information relevant to QA review of a class, library, computer program build, export to tape, or CPCR.

QA Discrepancy Report - A report issued by the QA group leader to document deficiencies discovered during QA audits. It can be issued to document non-conformance to QA instructions or to evoke corrective action for substandard products.

QA/Element Controlled Library - An automated program library or support system under the joint control of QA and the individual element that stores all of each element's work products (e.g., source code, object code, test cases, etc.). The system may operate in batch or interactive mode, or both. It usually will provide for multiple versions of a file, with one version of each tagged as the production version. Files are usually provided for source code, object code, and program data. The QA/element controlled library is managed by an Element Librarian. The QA/element controlled libraries taken together make up the controlled library for the project.

QA Verification Notice - VAX Mail Message sent by QA to the element stating that the verification of their program is complete and ready to be transferred to the element disk.

Quality Assurance (QA) - (1) A planned and systematic pattern of all action necessary to provide adequate confidence that the item or product conforms to established technical requirements. (2) The process or activity during which the system design is audited to determine whether it represents a verifiable certifiable specification, and during which test plans and procedures are formulated and implemented. This activity ensures the technical compliance of the system--a product--to its requirements and design specifications. QA is an independent audit review of all products to ensure their compliance to a management-directed standard of quality. (3) Guarantee made by the developer to the customer that the system meets minimum levels of acceptability. The criteria for acceptability should be mutually agreed upon, measurable, and put into writing. Primarily, though not necessarily, quality is assured through some form of testing.

Radar System AN/SPY-1A(B,D) - Primary air and surface radar for the AEGIS Combat System. It is a multi-function phased-array radar capable of search, automatic detection, transition to track, and track of air and surface targets located in preselected coverage volumes. Digital control, high-power output, and advanced signal processing techniques are used to provide adaptive search and multi-target tracking. Capable of operating in both heavy clutter and ECM environments. Has a high track capacity and is effective against a wide spectrum of target characteristics. Communicates with the SM-2 through its flight to exchange mid-course guidance commands and missile status messages.

Request Letter - A letter prepared by N05 requesting that Martin Marietta generate and deliver or transmit computer program products or services under an existing contract.

SC/ICR Package - A collection of related pages pertaining to an AEGIS SC or ICR to be considered or acted upon as one unit. The related pages are derived from interface design specification change requests (ICRs) or specification changes (SCs). The change package is initiated by the AEGIS element engineers and submitted to the AEGIS Change Review Board for approval. Once approved, it is incorporated into a specification or specification change notice (SCN).

Ship Availability Schedule - A procedural plan that indicates the time and sequence of ships' availability to accept new or upgraded computer program installations. This schedule is compiled by N211 based on Master Planning Schedules issued by the AEGIS Program Manager (PMS400).

Shipboard Installation Plan - A schedule generated by the Installation Manager that lists all necessary steps and procedures needed to implement shipboard computer program installation.

Software Design Document - A document, prepared to a standard, that describes the design of a software system or component. Contents may include architecture, control logic, data structures, input/output formats, interface design descriptions, and algorithms.

Software Implementation Board (SIB) - Organization at Martin Marietta responsible for review of changes to AWS computer programs and the AWS MK 7 element-to-element interfaces for development systems. Copies of all AWS CPCRs and ICRs intended for resolution by the SIB are sent to the CRB to provide an insight into development activities and to assess for applicability to in-service programs.

Software Trouble Report (STR) - Mechanism for reporting errors or problems to be fixed or suggested improvements (enhancements) in computer programs. Equivalent to CPCR for AEGIS.

Source Code Analyzer - A computer program used to provide source language or execution frequency statistics at the program or source-statement level to assist in performance evaluation and determination of test case coverage.

Specification - A document clearly and accurately describing the essential technical requirements for any component; the document is written to a standard such as DOD-STD-1679A.

Specification Change (SC) - Proposed modification or addition to an AWS or ACS tactical or simulation requirements document. An SC undergoes an approval process before issuance in an SCN.

Specification Change Notice (SCN) - Document for transmitting and recording a specification change under MIL-STD-490A. An SCN may incorporate one or more authorized SCs. New specifications do not require an SCN cover.

Specification Language File - A file containing statement blocks that accurately identify the contents of the user-defined tables (UDT) that are used by ATES. The SYSBLD user also applies the specification language to the definition of user application modules that are built based on information provided by REL files and subsequently incorporated into the target load file (TLF).

Specification Tree - A diagram that depicts all of the specifications for a given system and shows their relationships to one another.

Support Programs - (1) All programs used in the development and maintenance of the delivered operational programs and test/maintenance programs. Includes (a) compilers, assemblers, emulators, builders, and loaders required to generate machine code and to combine subprograms or components into a complete computer program; (b) debugging programs; (c) stimulation and simulation programs used in operator training sites; (d) data abstraction and reduction programs applicable to operational programs; (e) test programs used in development of operational programs; (f) programs used for management control, configuration management, or document generation and control development. (2) A computer program that facilitates the design, development, testing, analysis, evaluation, or operation of other computer programs. (3) Development tools used by project personnel for computer program design, debugging, testing verification, and management.

System Design Review Team (SRT) - A team designated by the Combat Systems Engineer (PMS400B3) to support the Design Review Process.

System Tape Builder Utility (SYSBLD/7, SYSBLD/43, SYSBLD/44) - System generation function for the AEGIS tactical system that executes in the VAX/VMS time-sharing system environment to build tactical program tapes/disks.

System/Segment Specification (Type A) - Specification prepared to practices set forth in military standard MIL-STD-490A. It states the technical and mission requirements for a system/segment as an entity, allocates requirements to functional areas, documents design constraints, and defines the interfaces between or among the functional areas. There is a Type A specification for the AEGIS Combat System (ACS) and a Type A specification for the AEGIS Weapon System (AWS); both are maintained by PMS400B.

Tactical Utility Function (TUF) - An operating system residing on the AN/UYK-43 and providing the same functions as the AEGIS Tactical Utility System. See ATUS.

Tape Label Description Form - A form containing program name, baseline, version, originating element, and, if required, a QA stamp denoting QA control is affixed. It is used for tracking purposes in the AEGIS Tape Library.

Tape Listing - A directory listing of all files located on a specific tape.

Test Observation Report (TOR) - The vehicle to document initial apparent problems observed during System Test events. These initial observations may also include questions concerning computer program operations, interfaces, or specifications.

Tool (Software Tool) - A computer program used to help develop, test, analyze, or maintain another computer program or its documentation; e.g., compiler, test tool.

Trade-off - A balancing of factors all of which are not attainable at the same time.

Ultra 16 Assembly Language - Language used for 16-bit AN/UYK-44.

Unit - A unit is normally a CMS-2 procedure (or other programming language equivalent). However, in some cases, a unit may be defined as a small number of procedures due to the way functions are allocated.

Update - A quick fix to a computer program that will solve a severe operational ship problem. The solution is in patch form and installed shortly after the ship reported the problem.

Upgrade - A significant increase in a ship's baseline functional and operational capability. Changes may be made to combat system operating spaces, equipment, weapons, and computer programs.

User Library - Any non-QA/Element Controlled Library is considered to be a user library. It is a VAX-based library established for tracking changes to computer programs made by individual programmers. A User Library may be under the control of an individual programmer, or more frequently, under the control of the element.

Vu-Graph - A coined word covering a wide variety of documentation, usually formatted in abbreviated style as for presentation as a visual aid and not under configuration control.

Weapons Control System (WCS) - As an element of the AEGIS Weapon System, performs target engagement scheduling and/or weapon control functions for Standard Missile, Harpoon, 5-inch, 54-caliber guns, and Phalanx. Control is also provided for ASW aircraft, LAMPS helicopters, and air interceptors.

White Paper - A detailed or authoritative report stating a position and released at the Element (or equivalent) level, not under configuration control.

Work Order - A form containing specific step-by-step instructions on how to perform a particular task. It contains an area for tracking information needed to compile a complete audit trail of tasks performed.

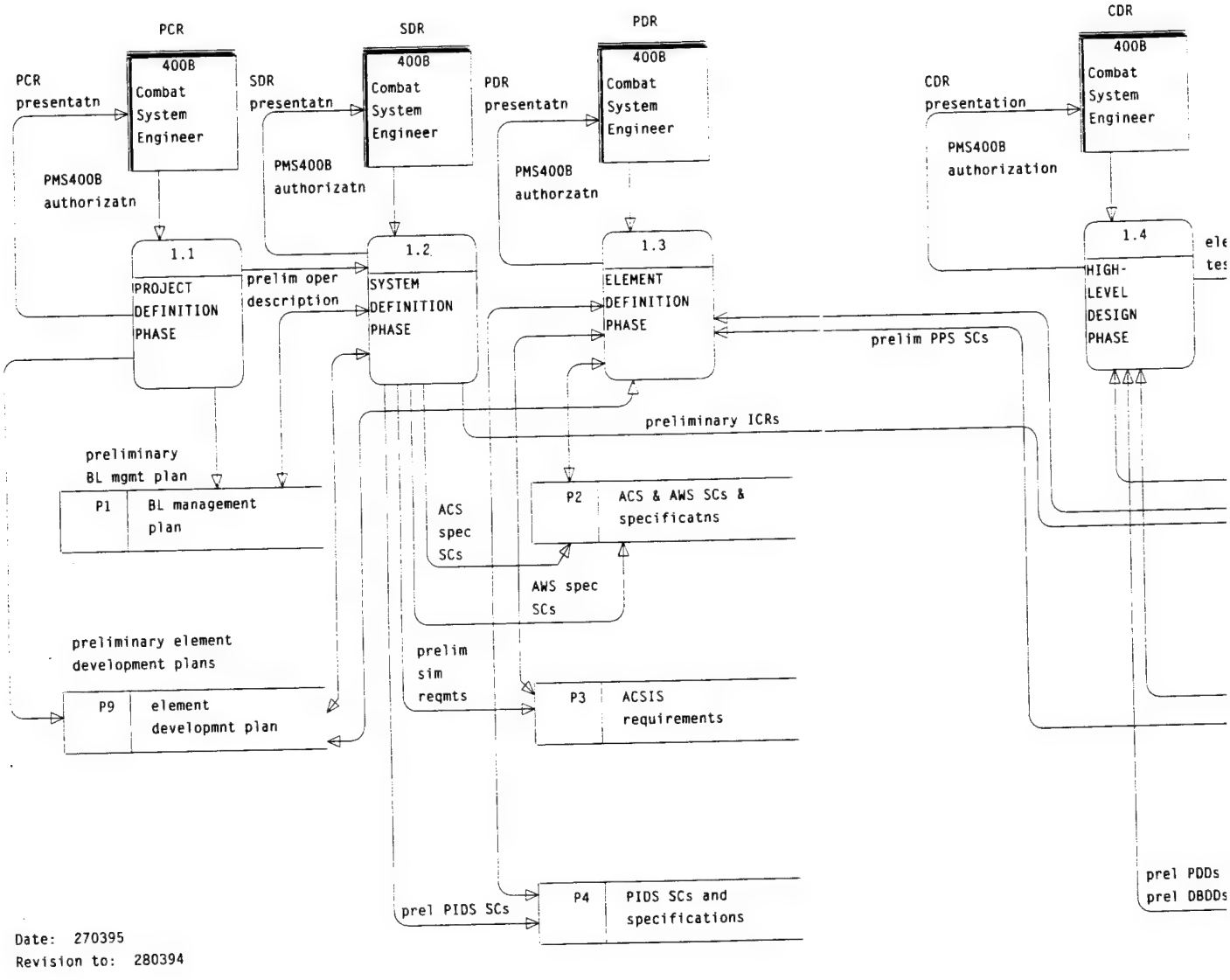

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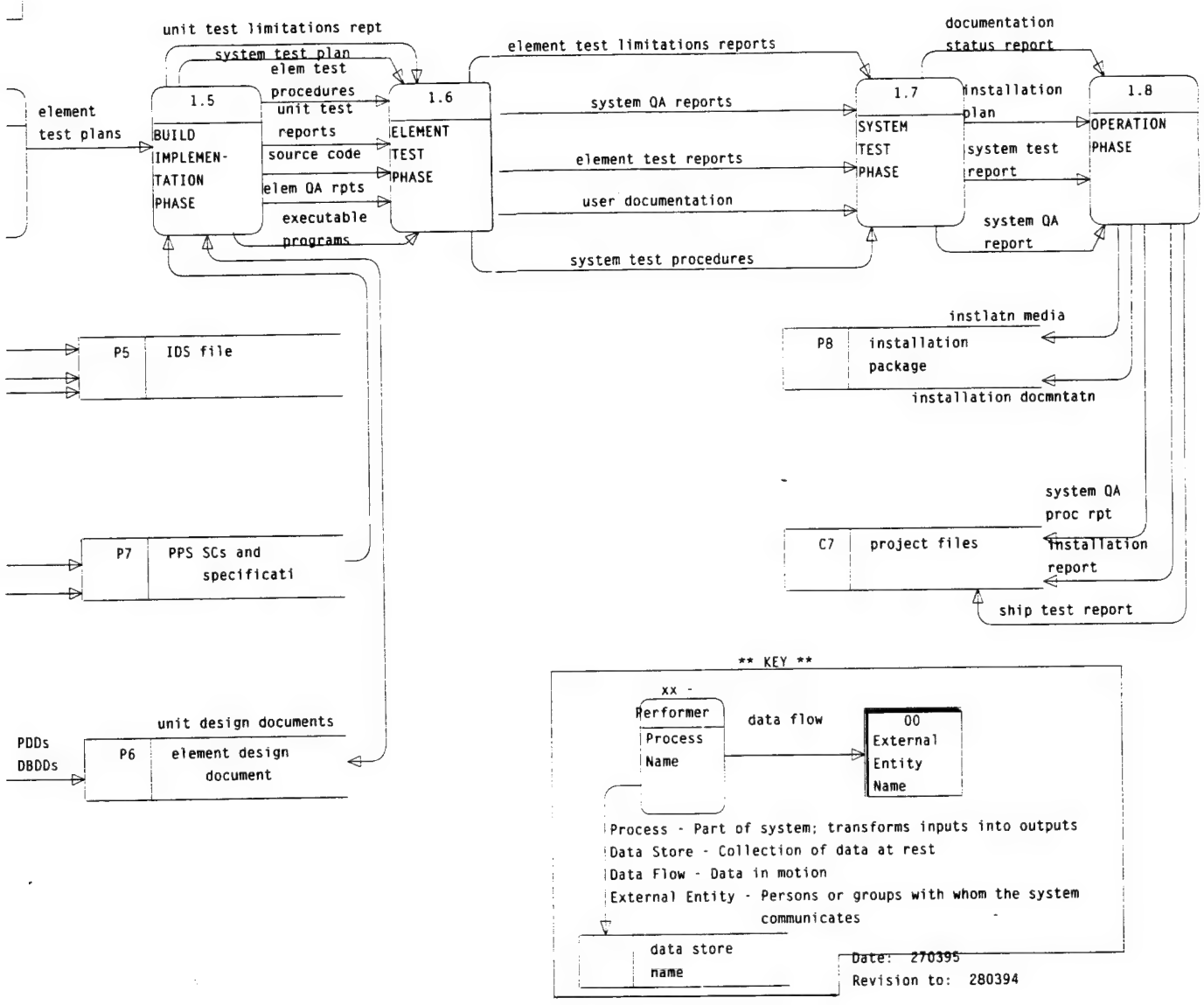
DIAGRAM 1 - THE EIGHT AWS SOFTW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documentation status report
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1.5
BUILD IMPLEMEN-TATION PHASE
1.6
ELEMENT TEST PHASE
1.7
SYSTEM TEST PHASE
1.8
OPERATION PHASE
P5 IDS file
P7 PPS SCs and specificati
P6 element design document
PDDs
DBDDs
unit design documents
instlatn media
P8 installation package
installation docmntatn
system QA proc rpt
C7 project files
installation report
ship test report
** KEY **
xx - Performer Process Name
data flow
00 External Entity Name
Process - Part of system; transforms inputs into outputs
Data Store - Collection of data at rest
Data Flow - Data in motion
External Entity - Persons or groups with whom the system communicates
data store name
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ACS Specification Change (SC) Lists
AWS SC Lists
ACSIS Interface Message Specification (IMS) Change Request (AICR) Lists

The single control event for this phase is the Project Commitment Review (PCR), whose purposes are to assess completeness of project scope and resources and to obtain PMS400 commitment.

TABLE II-1. MATRIX OF PROCESSES IN THE PROJECT DEFINITION PHASE AND THEIR CONSTITUENT ACTIVITIES

PROCESS	ACTIVITY NUMBER	TITLE	DATE
Develop Proposed Baseline Definition	1.1.1.1	Initiate Baseline Discussions	31 Aug 93
	1.1.1.2	Develop Candidate Baseline Definition List	31 Aug 93
	1.1.1.3	Review Proposed Baseline Definition With Program Office	31 Aug 93
	1.1.1.4	Outline Baseline Strategy	31 Aug 93
Obtain Program Office Concept Approval	1.1.2.1	Baseline Definition and Strategy Correlation	31 Aug 93
	1.1.2.2	Approve Baseline Continuation	31 Aug 93
	1.1.2.3	Notify PMS400B and Terminate Baseline	31 Aug 93
	1.1.2.4	Identify Baseline Candidates	31 Aug 93
Develop Baseline Candidate Definition	1.1.3.1	Conduct System Engineering Studies	31 Aug 93
	1.1.3.2	Select/Define Baseline Candidates	31 Aug 93
	1.1.3.3	Prepare Draft Preliminary Baseline Management Plan	31 Aug 93
	1.1.3.3A	Review Draft Preliminary Baseline Management Plan	27 Mar 95
	1.1.3.4	Review Preliminary Baseline Definition	31 Aug 93
	1.1.3.5	Review Support Activity Plans	31 Aug 93
	1.1.3.6	Assess AEGIS Combat System and Ship Impacts	31 Aug 93
Develop Scope, Schedule, Resource, and Risk Estimates	1.1.4.1	Evaluate Organization Impact	31 Aug 93
	1.1.4.2	Develop Preliminary Scope, Schedule, Resource, and Risk Estimates	29 Jul 94
	1.1.4.3	Coordinate Organization Estimates	29 Jul 94
	1.1.4.4	Assess Baseline Workload Impact	31 Aug 93
	1.1.4.5	Review Recommended Baseline Definition	31 Aug 93
	1.1.4.6	Prepare Baseline Definition Presentation	31 Aug 93
	1.1.4.7	Present Baseline Definition to NSWCDD Organizations	31 Aug 93
	1.1.4.8	Update Scope, Schedule, Resource, and Risk Estimates	29 Jul 94
	1.1.4.9	Update Draft Preliminary Baseline Management Plan	29 Jul 94
Obtain NSWCDD Project Final Approval	1.1.5.1	Conduct Baseline Program Review	29 Jul 94
	1.1.5.2	Accept Preliminary Baseline Management Plan	29 Jul 94
	1.1.5.3	Prepare PCR Presentation for PMS400B	29 Jul 94
	1.1.5.4	Conduct PCR Presentation Dry Run	31 Aug 93
	1.1.5.5	Update PCR Presentation	31 Aug 93
	1.1.5.6	Approve PCR Presentation	31 Aug 93
Obtain PMS400B Project Authorization	1.1.6.1	Conduct PCR	31 Aug 93
	1.1.6.2	Update Baseline Definition Per PMS400B Direction	31 Aug 93
	1.1.6.3	Authorization to Proceed to System Definition	31 Aug 93

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Activity: PD-1.1.3.3A

REVIEW DRAFT PRELIMINARY BASELINE MANAGEMENT PLAN

The draft preliminary baseline management plan is reviewed prior to being released by Baseline Management. The review team normally includes only one representative from each of the following organizations: Baseline Management, System Engineering, System Test and Integration, and an Element representative. Baseline Management requests support from the relevant organizations to support the review. The review ensures that the draft preliminary baseline management plan is ready for review for concurrence by organizations affected by the documented plans. Results of the review are documented in the baseline development folder maintained by Baseline Management. Corrective action is taken if warranted.

RESPONSIBLE ORGANIZATION:	Baseline Management
SUPPORTING ORGANIZATION:	System Engineering ST&I Elements
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	None

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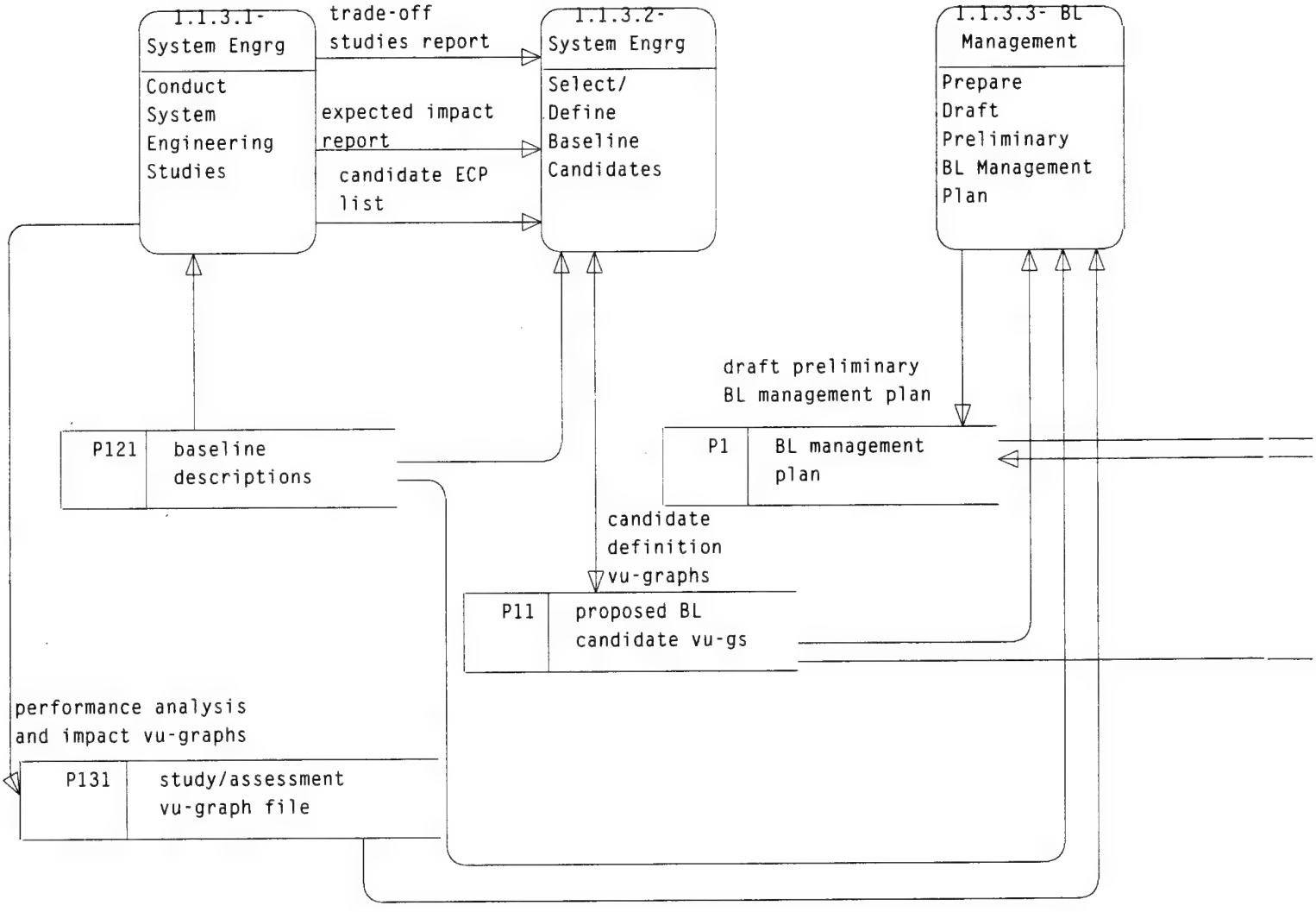

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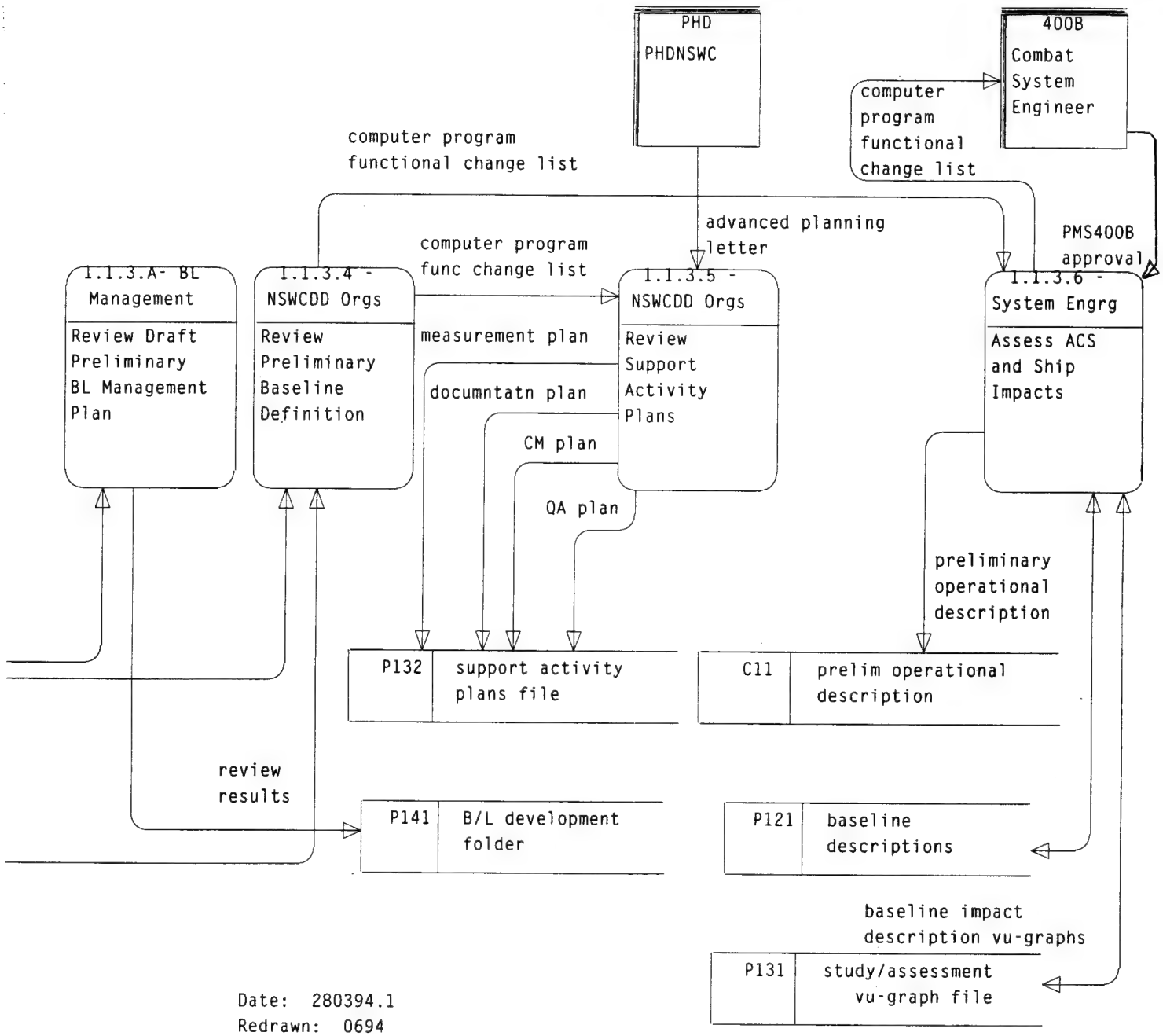
DIAGRAM 1.1.3 - DEVELOP BASELINE C



CANDIDATE DEFINITION PROCESS

Activities, Products, and Control Event

Each of these processes consists of a number of activities. Table 1-3 is a matrix of the processes and their constituent activities.

The key products of this phase, as shown in the process model in Part I, are
PIDS SCs
Preliminary ICRs
Preliminary PPS SCs
Updated Element Development Plan
Simulator Requirements
PDR Presentation

Other products expected to result from conduct of the activities are listed below:[1]

Schedules
Resource Allocation
Patch Conversion Plan
Element Performance Disclosure
Development Tools Definition
Analysis Tools
Element Support Tools
CASE Tools
Element Test Concept Definition
Identified List of ACTS and CAST Lessons
Allocated CPCR List
Man/Machine Interface Requirements Definition
Data Analysis Requirements Definition
User Documentation Plan
Crew Training Impact Report
Baseline Development Folders

The single control event for this phase is the Preliminary Design Review, whose purposes are to review validity and completeness of the allocated requirements as defined in the PIDSs, PPSs, and IDSs; apprise PMS400 of progress and plans; and obtain PMS400 authorization to proceed.

[1]In the event of a discrepancy between this list and the details shown in the process flows and activities that follow, the activities and flows should be followed.

TABLE 1-3. MATRIX OF PROCESSES IN THE ELEMENT DEFINITION PHASE AND THEIR CONSTITUENT ACTIVITIES

PROCESS	ACTIVITY NUMBER	ACTIVITY TITLE	DATE
Conduct Element Analysis and Define PPS SCs and ICRs	1.3.1.1	Define Required PPS SCs/ICRs	29 Jul 94
	1.3.1.2	Perform Requirements Analysis	29 Jul 94
Prepare and Review Preliminary ICRs	1.3.2.1	Prepare Preliminary ICRs	18 Nov 93
	1.3.2.2	Conduct Side A ECCB Review and Approval of Preliminary ICRs	18 Nov 93
	1.3.2.3	Conduct Side B ECCB Review and Approval of Preliminary ICRs	18 Nov 93
	1.3.2.4	Conduct NSWCDD MK7 ICWG Evaluation of Preliminary ICRs	18 Nov 93
	1.3.2.5	Conduct AWS CRB Preliminary ICR Processing	18 Nov 93
	1.3.2.6	Present Non MK7 Preliminary ICRs for Non MK7 ICWG Review and Approval	18 Nov 93
Prepare and Review Preliminary PPS SCs	1.3.3.1	Prepare Preliminary PPS SCs	29 Jul 94
	1.3.3.1A	Inspect Preliminary PPS SCs	29 Jul 94
	1.3.3.2	Conduct ECCB Review and Approval of Preliminary PPS SCs	18 Nov 93
	1.3.3.3	Conduct AWS CRB Preliminary PPS SC Processing	18 Nov 93
Update Element Development Plans and Support Program Requirements	1.3.4.1	Update Element Development Plans	18 Nov 93
	1.3.4.1A	Review Element Development Plans	27 Mar 95
	1.3.4.2	Update Simulator Requirements	18 Nov 93
	1.3.4.3	Develop Element Test Concept	18 Nov 93
	1.3.4.4	Initiate System Test Planning	18 Nov 93
	1.3.4.5	Update Baseline Contents	18 Nov 93
Develop and Review PDR Data Package	1.3.5.1	Prepare PDR Data Package	18 Nov 93
	1.3.5.2	Distribute PDR Data Package for Review	18 Nov 93
	1.3.5.3	Conduct PDR Data Package Review	18 Nov 93
	1.3.5.4	Support ERT Review of PDR Data Package Comments	18 Nov 93
	1.3.5.5	Support SRT Review of ERT Comments on PDR Data Package	29 Jul 94
Prepare PDR Presentation and Conduct PDR	1.3.6.1	Prepare Element Portion of PDR Presentation	18 Nov 93
	1.3.6.2	Prepare System Engineering Portion of PDR Presentation	18 Nov 93
	1.3.6.3	Prepare Baseline Management Portion of PDR Presentation	18 Nov 93
	1.3.6.4	Conduct Management Review of PDR Presentation	18 Nov 93
	1.3.6.5	Conduct PDR	18 Nov 93
	1.3.6.6	Update PDR Data Package Per PMS400B Direction	18 Nov 93
Approve and Distribute SCNs and New Specifications	1.3.7.1	Process and Distribute IDS SCNs and New IDSs	18 Nov 93
	1.3.7.2	Obtain Element Approval of IDS SCNs	18 Nov 93
	1.3.7.3	Obtain System Engineering Approval of IDS SCNs	18 Nov 93
	1.3.7.4	Prepare PPS SCNs	18 Nov 93
	1.3.7.5	Obtain Approval of PPS SCNs	18 Nov 93
	1.3.7.6	Distribute PPS and MK7 IDS SCNs	18 Nov 93

The Conduct Element Analysis and Define PPS SCs and ICRs Process is comprised of two activities as described below. Diagram 1.3.1 (Page II-3-9) is a data flow diagram of the process and its constituent activities.

Activity: ED-1.3.1.1

DEFINE REQUIRED PPS SCs and ICRs

The Element leader and engineers consider the AWS and ACS SCs, the preliminary ICRs and IDSs developed in the System Definition Phase, the PIDS SCs, fleet requests, lessons learned, known design shortcomings, non-Mk 7 modifications, and the baseline management plan; they begin to specify the functional design and compile a definition of the required PPS SCs and ICRs. Finally, the engineers make a determination about the patches to be converted to source code and allocate them to the builds. They document these components in the Element development plans. An example of the data considered for establishing the baseline definition is the Government Electronic Systems-approved forward-fit PPS SCs and the PMS400B-approved ICRs. Element leaders then update the baseline definition list that contains the SCs, ICRs, and CPCRs planned for incorporation and the Element development schedule. They coordinate the schedule with Baseline Management.

PERFORMER:	Elements
SUPPORTING ORGANIZATION:	Baseline Management AWS CRB CM System Engineering Fleet Support
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	DMI-002

Activity: ED-1.3.1.2

PERFORM REQUIREMENTS ANALYSIS

Element engineers perform the required analysis to document the requirements in preliminary SCs at the PPS level and identify the ICRs that are required at the IDS level. System changes that affect multiple Elements are specified in multi-element working groups initiated and coordinated by System Engineering. If changes are required to the PIDS SCs due to the preliminary PPS SCs and ICRs, the changes are made and the previous change control cycle is repeated. The analysis includes an evaluation of the proposed changes and identification of data analysis requirements.

The Elements develop and document design goals that form the basic guidance for computer program designers to make appropriate choices in deciding among alternatives as they implement allocated requirements. Such goals should include one or more of the following (including specified priorities when multiple goals are specified):

- Resource conservation (minimizing impact on core, time utilization, or interface impact)
- Efficiency (i.e., the resources required by a program; each of the following resources must be considered: cpu, memory, online storage, I/O and human development effort)
- Maintainability (i.e., the effort required to locate and correct an error)
- Flexibility (i.e., the effort required to modify an operational program)
- Reusability (i.e., the extent to which parts of a program can be reused in other applications)

For new requirements that cross several Elements and require modeling and computer simulation, System Engineering coordinates the analysis/modeling/simulation efforts between the impacted elements.

The requirements analysis data includes evidence that the problem impacts are well understood. Typical analysis products may include:

(1) Models of algorithms
(2) Models of data or user interface design
(3) Control flow model of change
(4) Evaluation of model performance
(5) Preliminary impact assessment - schedule, cost, time, core, etc.
(6) An understanding of the domain of change (The parts of the system that change should be documented within a boundary of system components that do not change. This should adequately address logical structure, data flow, and control flow at the PPS level.)
(7) Presentation of results documented in reports, graphs, white papers, etc.

These inputs are compiled in the Element functional development folders. The Element leader uses the results of the requirements analysis to refine the preliminary SC list for input to Baseline Management.

PERFORMER:	Elements
SUPPORTING ORGANIZATION:	Baseline Management System Engineering AEGIS Ships
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	None

The Prepare and Review Preliminary ICRs Process is comprised of six activities as described below. Diagram 1.3.2 (Page II-3-15) is a data flow diagram of the process and its constituent activities.

Activity: ED-1.3.2.1

PREPARE PRELIMINARY ICRs

During this activity, the detailed message contents are identified and sections 3 and 8 of the IDS are completed. Element engineers, after reviewing the A-level and B-1 level SCs, preliminary ICRs from the System Definition Phase, and preliminary PPS SCs; then develop and document message content. A preliminary NSWCDD Mk 7 ICWG is held to identify the Element (side A) that is primarily responsible for generating the new ICRs. The side A Element prepares the ICR.

Formal inspections are conducted using the PPS Standard of Excellence Checklist and in accordance with approved inspection procedures.

The ICRs may be internal to the AWS, meaning the interface is a Mk 7 Element to another Mk 7 Element or external to the AWS, meaning a Mk 7 Element to a non-Mk 7 Element. Sometimes side A may be the non-Mk 7 Element and the interface is to a Mk 7 Element.

PERFORMER:	Elements
SUPPORTING ORGANIZATION:	System Engineering
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	NSWCDD AEGIS (Preliminary) Standard for Software Engineering Inspections AEGIS Instruction 4857

Activity: ED-1.3.2.2

CONDUCT SIDE A ECCB REVIEW AND APPROVAL OF PRELIMINARY ICRs

Side A ECCB, in consultation with the Element engineers, reviews the preliminary ICRs. Their review ensures that interface requirements are complete, are correct, and conform to protocol agreements; assesses the impact on PPS requirements; and ensures that the preliminary PPS SCs are consistent with the new ICRs. They evaluate the impact of the change on the Element and its resources. If the Element development schedule is impacted, the Element leader negotiates any changes with Baseline Management. Upon completion of the side A technical review, the side A Element's ECCB approves or disapproves the ICR. If the ICR is disapproved, it may be sent back to the Element engineer for revision, or a meeting with the other Element involved may be required to resolve issues. If the ICR is approved, the ECCB signs the ICR and the side A Element.

the ICR and the side A Element submits the preliminary ICR to the AWS CRB CM. The Elements update the functional development folders with the preliminary ICRs. AWS CRB CM logs the preliminary ICRs into ACCESS, assigns log numbers to them, and coordinates with side B for Element approval.

PERFORMER: ECCB

SUPPORTING ORGANIZATION: AWS CRB CM

APPROVAL REQUIRED: None

APPLICABLE INSTRUCTION: None

Activity: ED-1.3.2.3

CONDUCT SIDE B ECCB REVIEW AND APPROVAL OF PRELIMINARY ICRs

Upon receipt of a preliminary ICR from the AWS CRB CM, side B Element ECCB evaluates the ICR with other supporting change requests, i.e., SCs, ICRs, CPCRs, and FLCRs. They evaluate the impact of the change on the Element and its personnel resources. If the Element development schedule is impacted, the Element leader negotiates any changes with Baseline Management. Upon completion of side B's review and ECCB approval, the ICR is forwarded, via the AWS CRB CM, to System Engineering for coordination of the NSWCDD MK 7 ICWG review.

If side B disapproves, the ICR issues are forwarded to System Engineering for technical resolution at the NSWCDD MK 7 ICWG. The ICR is returned to side A, via AWS CRB CM, for revision based on the results of the IWCG.

PERFORMER: ECCB

SUPPORTING ORGANIZATION: AWS CRB CM

APPROVAL REQUIRED: None

APPLICABLE INSTRUCTION: DMI-002

Activity: ED-1.3.2.4

CONDUCT NSWCDD MK 7 ICWG EVALUATION OF PRELIMINARY ICRs

NSWCDD MK 7 ICWG, chaired by System Engineering, with support from the side A and side B Elements, evaluates the preliminary ICRs to ensure they fulfill the new system requirements and to identify any conflicts. They work with the side A and

The Prepare and Review Preliminary PPS SCs Process is comprised of four activities as described below. Diagram 1.3.3 (Page II-3-19) is a data flow diagram of the process and its constituent activities.

Activity: ED-1.3.3.1

PREPARE PRELIMINARY PPS SCs

The Element engineers consider the high-level SCs, preliminary ICRs, and Element analysis or study results to develop new algorithms and preliminary PPS requirements. Element engineers meet to review and resolve issues associated with the requirements. Additionally, Element engineers evaluate Element analysis programs and models for impact and plan for upgrades of those programs to precede tactical program development. IDSs and ICRs are evaluated to determine if further changes are required. Element models or analysis tools may be updated to assist in requirements decisions. The responsible engineers record the requirements in preliminary PPS SCs and prepare required FLCRs.

PERFORMER:	Elements
SUPPORTING ORGANIZATION:	None
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	DMI-002 NSWCDD AEGIS (Preliminary) Standard for Software Engineering Inspections AEGIS Instruction 4857

Activity: ED-1.3.3.1A

INSPECT PRELIMINARY PPS SCs

The respective Element conducts an inspection of the preliminary PPS SCs according to approved standards and using approved checklists. The inspection verifies that the form and described functions are complete, consistent (internally as well as with other documents such as IDSs), and accurate. The inspection also focuses on the appropriateness of the content of the information.

PERFORMER:	Elements
SUPPORTING ORGANIZATION:	NSWCDD Organizations
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	NSWCDD AEGIS (Preliminary) Standard for Software Engineering Inspections AEGIS Instruction 4857

Activity: ED-1.3.3.2

CONDUCT ECCB REVIEW AND APPROVAL OF PRELIMINARY PPS SCs

The ECCB, in conjunction with the Element engineers, reviews the preliminary PPS SCs. They evaluate the impact of the change on the Element and its resources. The ECCB assesses both the technical accuracy of the proposed change as well as whether the proposed change can be executed. If the Element development schedule is impacted, the Element leader negotiates any changes with Baseline Management. The ECCB approves (or disapproves) the PPS SCs when the reviews are complete. The Elements update the functional development folder with the preliminary PPS SCs. The ECCB then submits the PPS SCs to AWS CRB CM.

PERFORMER:	ECCB
SUPPORTING ORGANIZATION:	Baseline Management AWS CRB CM
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	DMI-001 DMI-002

Activity: ED-1.3.3.3

CONDUCT AWS CRB PRELIMINARY PPS SC PROCESSING

AWS CRB CM ensures that the PPS SCs have been reviewed and approved by the ECCBs and that any associated ICRs, SCs, FLCRs, and CPCRs are part of the review package. (If the SCs are distributed with sufficient lead time before the AWS CRB meeting, Documentation Management inserts copies of the SCs into the dynamic working copies of the affected specifications, which are available for review in the AEGIS Data Center.) The AWS CRB then approves (or disapproves) and signs off on the SCs, and the AWS CRB CM updates the status of the PPS SCs in the ACCESS database. Documentation Management incorporates those approved SCs that were not previously placed in the dynamic working copies and makes necessary adjustments to those SCs that were placed in the dynamic working copies prior to the AWS CRB.

PERFORMER:	AWS CRB
SUPPORTING ORGANIZATION:	Elements AWS CRB CM Documentation Management
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	DMI-001

The Update Element Development Plans and Support Program Requirements Process is comprised of six activities as described below. Diagram 1.3.4 (Page II-3-25) is a data flow diagram of the process and its constituent activities.

Activity: ED-1.3.4.1

UPDATE ELEMENT DEVELOPMENT PLANS

Based on the ECCB requirements analysis and impact assessment, the PPS SCs, the ICRs, and the PIDSs changes, each Element updates its Element development plan. The plans include a definition of the build functionality; a list of the approved PPS SCs, ICRs, FLCRs, and allocated CPCRs; a description of resource impacts; element development schedules; and a description of and plan for managing identified risks. The Element leader forwards the updated Element development schedule to Baseline Management. Any schedule changes that impact the baseline schedule are approved by Baseline Management.

PERFORMER:	Elements
SUPPORTING ORGANIZATION:	Baseline Management System Engineering
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	None

Activity: ED-1.3.4.1A

REVIEW ELEMENT DEVELOPMENT PLANS

Each Element reviews their Element development plan. The review verifies that the form and described functions are completed, consistent (internally as well as with other documents such as the baseline management plan), and accurate. The review also focuses on the appropriateness of the content of the information.

PERFORMER:	Elements
SUPPORTING ORGANIZATION:	None
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	None

Activity: ED-1.3.4.2

UPDATE SIMULATOR REQUIREMENTS

Based on preliminary PPS SCs and ICRs and Element development plans, AIS, Elements, System Engineering, ST&E, and the ATC engineers perform the required analysis to update the specific simulator performance requirements for the ACSIS systems and ORTSIS, if applicable. AIS engineers coordinate the defined requirements. The ATC, in consultation with Systems Simulation, develops training requirements. Any schedule changes that impact the baseline schedule are approved by Baseline Management.

PERFORMER:	NSWCDD Organizations
SUPPORTING ORGANIZATION:	ATC Baseline Management
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	None

Activity: ED-1.3.4.3

DEVELOP ELEMENT TEST CONCEPT

Based on performance and interface requirements, Elements review and analyze existing test plans and procedures for impact and identify required changes. Element test concepts are developed. Test concepts include (1) tests to be changed and their description, (2) new tests and their descriptions, and (3) selected regression tests to be conducted. Upon identification of the element test concept, each Element develops a schedule for test development and conduct. The products of this activity are used to update the element development plan.

PERFORMER:	Elements
SUPPORTING ORGANIZATION:	System Engineering
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	None

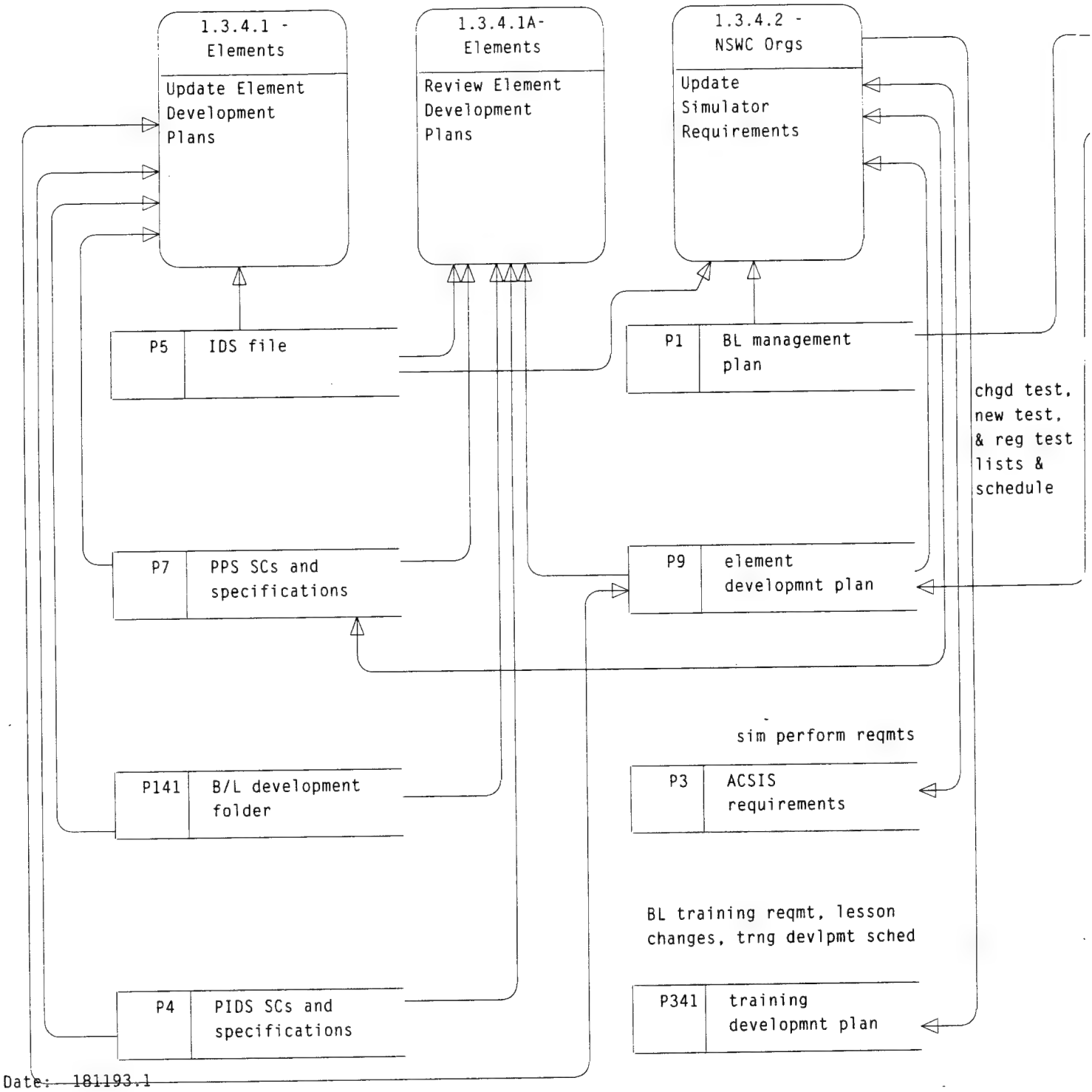


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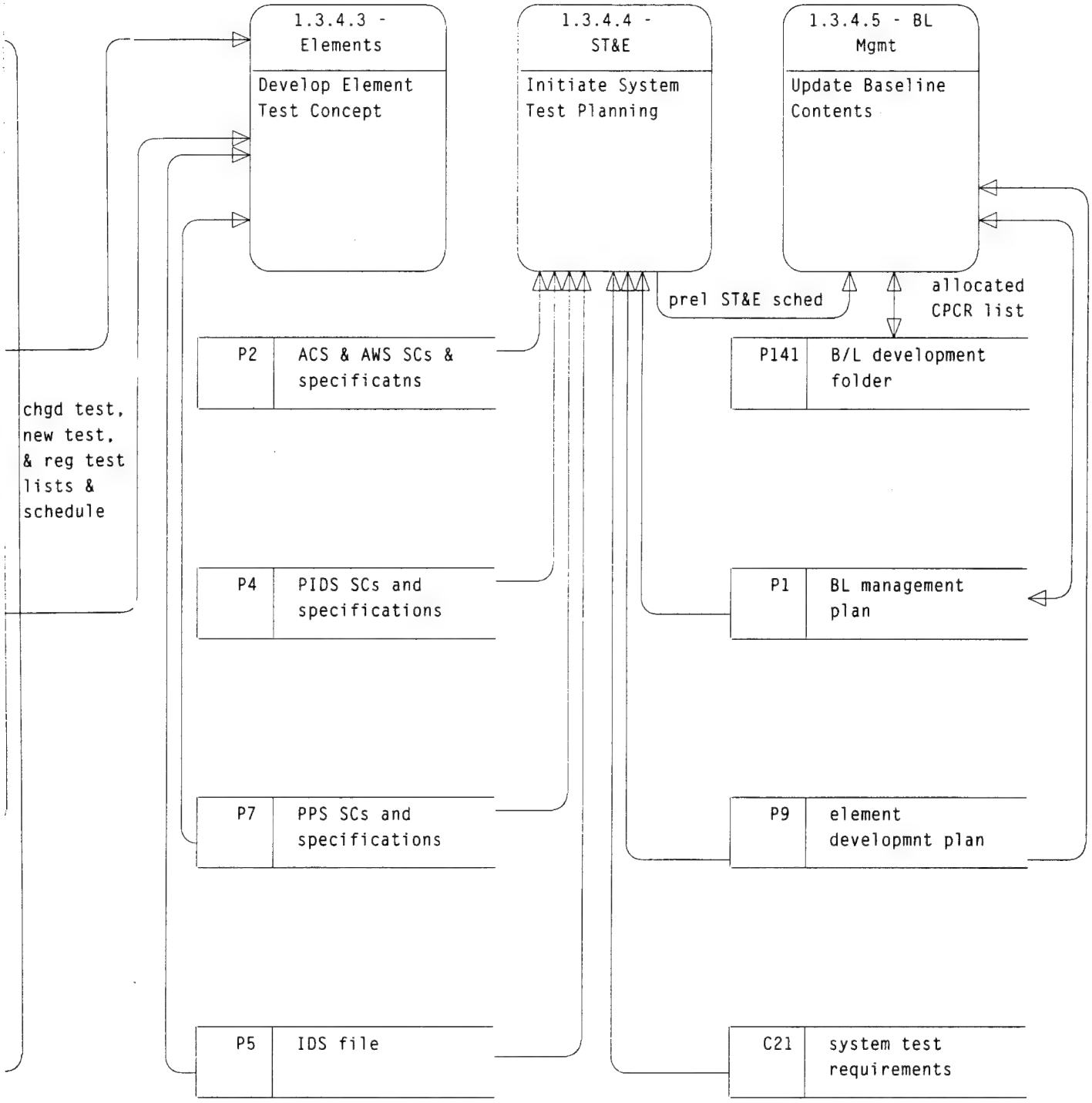
DIAGRAM 1.3.4 - UPDATE ELEMENT DEVELOPMEN PROGRAM REQUIREMENTS PRO



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EVELOPMENT PLANS AND SUPPORT MENTS PROCESS

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4. HIGH-LEVEL DESIGN PHASE

The High-Level Design Phase is concerned with the physical architecture of the AWS computer programs, functional allocation of requirements, and high-level design of the computer programs. This phase includes completing the specification of impacted interfaces to the message, word, and field level. This effort ensures that desired changes to the logical and physical system can be accomplished within the resources (memory and time) of each Element.

Each Element formulates the high-level design as required by approved PPS SCs, ICRs, and CPCRs. The Elements perform a preliminary design impact analysis, allocating requirements to modules and analyzing module interfaces. They select the appropriate architectural features and update the design documentation and affected specifications. The Elements then allocate requirements to procedures, define any impacts to procedure interfaces, and conduct a formal review of the high-level design of all areas of the computer program impacted by the change.

Following the review, the Elements define the build contents and build schedule and begin to plan their test activities. Element engineers analyze test requirements, identify required tests, and develop the Element test plan. A formal review of the Element test plan ensures the technical and management issues are addressed.

The control event for the High-Level Design Phase is the Critical Design Review (CDR). In preparation for this review, the Elements prepare a CDR data package describing each functional change and depicting the traceability of the change to the performance specification. Element Design Review Teams and the System Design Review Team review the package, and their comments are incorporated. System Engineering also prepares a CDR presentation describing system-level functional changes, and Baseline Management prepares an updated schedule for presentation at the CDR.

The CDR is coordinated by Baseline Management. Each organization presents its data package, and comments are solicited. Discussions focus on issues; open items; and any significant scope, schedule, and resource changes. Acceptance of the results by PMS400B and the Executive Panel represents authorization to proceed to the Build Implementation Phase.

Following the CDR, the Elements make any directed changes to the design documentation and update the baseline development folders with the current information. Baseline Management then updates the baseline management plan, and Documentation Management prepares and distributes the updated design documentation.

There are six processes in the High-Level Design Phase (see Table II-4):

Perform Preliminary Design Impact Analysis Process (1.4.1)
Develop High-Level Design Process (1.4.2)
Plan Development Activities Process (1.4.3)
Plan Test Activities Process (1.4.4)
Develop CDR Data Package Process (1.4.5)
Conduct CDR Process (1.4.6)

Diagram 1.4 (Page II-4-5) is a depiction of the High-Level Design Phase, including its six processes.

Activities, Products, and Control Event

Each of these processes consists of a number of activities. Table II-4 is a matrix of the processes and their constituent activities. The key products of this phase, as shown in the process model in Part I, are:

PPS SCs
ICRs
Element Test Plans
Program Design Documents
CDR Presentation

Other products expected to result from conduct of the activities are listed below:

Time and Memory Estimates
Data Analysis Definition

The single control event for this phase is the Critical Design Review (CDR). The purpose of the CDR is to:

Ensure that the physical architecture and high-level design satisfy the requirements
Review validity and completeness of design documentation and IDSs
Ensure interface working groups' approval of interface requirements
Apprise PMS400 of progress and obtain authorization to proceed

TABLE II-4. MATRIX OF PROCESSES IN THE HIGH-LEVEL DESIGN PHASE AND THEIR CONSTITUENT ACTIVITIES

PROCESS	ACTIVITY NUMBER	ACTIVITY TITLE	DATE
Perform Preliminary Design Impact Analysis	1.4.1.1	Allocate Requirements to Design Functions	27 Mar 95
	1.4.1.2	Allocate Design Functions to Modules	27 Mar 95
	1.4.1.3	Analyze Module Interfaces	27 Mar 95
	1.4.1.4	Select Architectural Features	27 Mar 95
	1.4.1.5	Develop/Update Required Documents	27 Mar 95
Develop High-Level Design	1.4.2.1	Allocate Requirements to Units	27 Mar 95
	1.4.2.2	Define Unit Interface Impacts	27 Mar 95
	1.4.2.3	Review High-Level Design	27 Mar 95
Plan Development Activities	1.4.3.1	Define Build Contents	27 Mar 95
	1.4.3.2	Define Build Schedule	27 Mar 95
	1.4.3.3	Update Planning Documents	27 Mar 95
	1.4.3.4	Review Build Definition and Schedule	27 Mar 95
	1.4.3.5	Prepare for Code Development	27 Mar 95
Plan Test Activities	1.4.4.1	Define Required Element Tests	27 Mar 95
	1.4.4.2	Develop Element Test Plan	27 Mar 95
	1.4.4.3	Develop System Test Requirements	27 Mar 95
Develop CDR Data Package	1.4.5.1	Prepare CDR Data Package	27 Mar 95
	1.4.5.2	Review CDR Data Package	27 Mar 95
	1.4.5.3	Review and Categorize CDR Data Package Comments	27 Mar 95
	1.4.5.4	Review ERT Comment Categories and Resolve Problems	27 Mar 95
Conduct CDR	1.4.6.1	Update Element CDR Presentation	27 Mar 95
	1.4.6.2	Prepare System Engineering CDR Presentation	27 Mar 95
	1.4.6.3	Prepare Facilities Engineering CDR Presentation	27 Mar 95
	1.4.6.4	Review Technical CDR Presentation Material	27 Mar 95
	1.4.6.5	Prepare Baseline Management CDR Presentation	27 Mar 95
	1.4.6.6	Conduct CDR Meeting	27 Mar 95
	1.4.6.7	Update Technical Documentation Per CDR Direction	27 Mar 95
	1.4.6.8	Review and Approve DDCRs	27 Mar 95
	1.4.6.9	Update Management Plans	27 Mar 95
	1.4.6.10	Update Engineering Documentation	27 Mar 95

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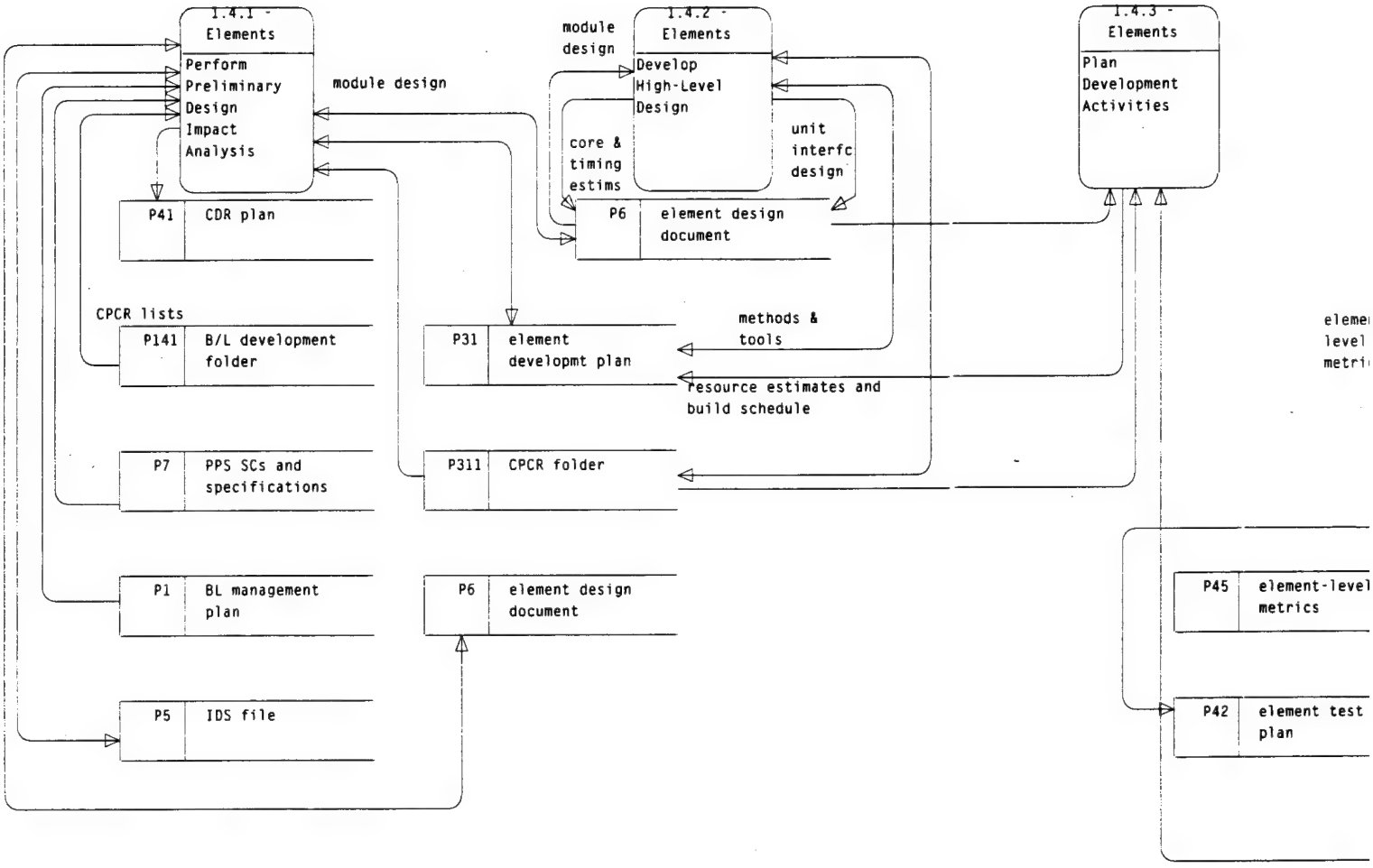
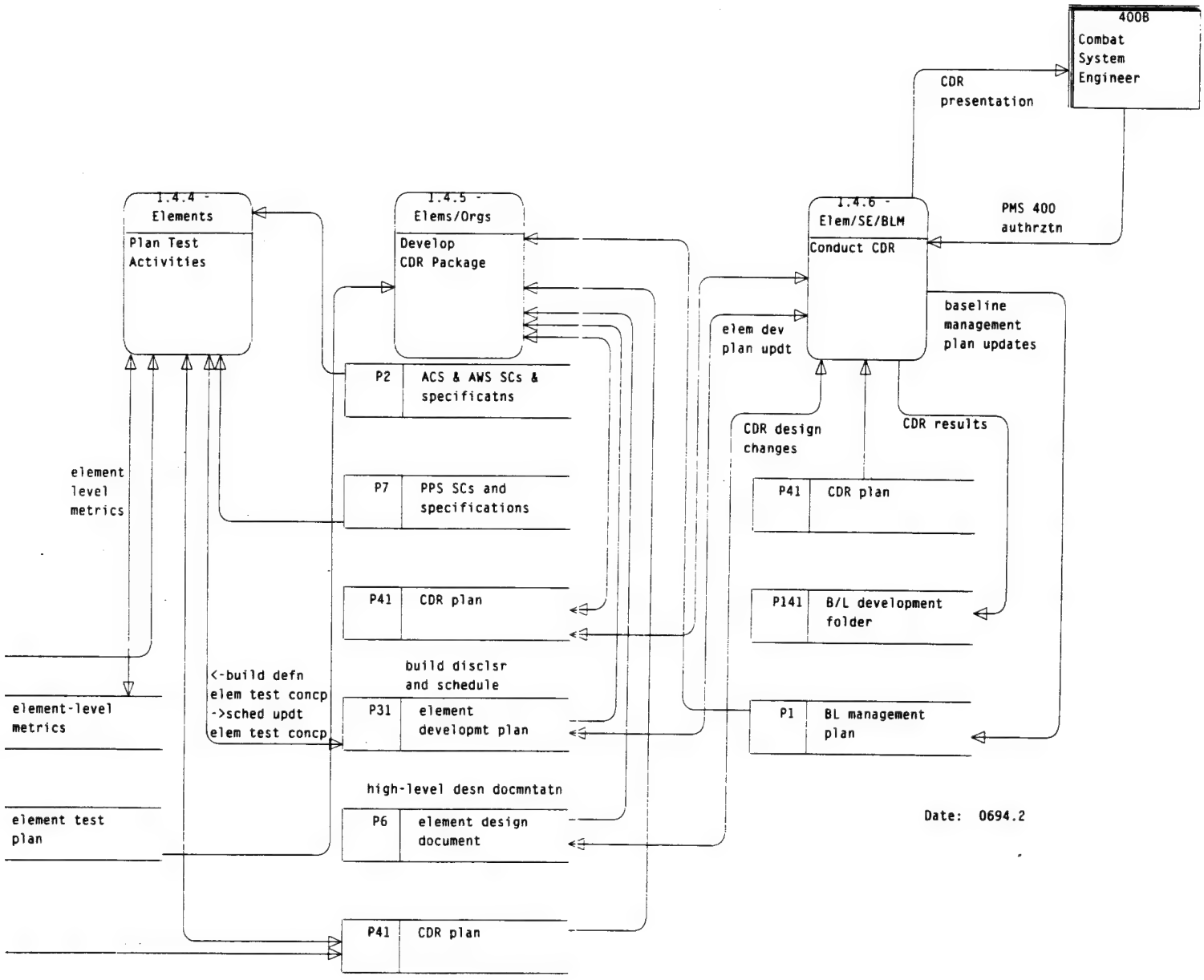


DIAGRAM 1.4. HIGH-LEVEL DES



/EL DESIGN PHASE

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1.4.1 PERFORM PRELIMINARY DESIGN IMPACT ANALYSIS PROCESS

The Perform Preliminary Design Impact Analysis Process is comprised of five activities as described below. Diagram 1.4.1 (Page II-4-11) is a data flow diagram of the process and its five constituent activities.

Activity: HLD-1.4.1.1

ALLOCATE REQUIREMENTS TO DESIGN FUNCTIONS

Element personnel review all SCs planned for the current baseline in conjunction with the current design functions as documented in the Element design document. Each new or modified requirement is tentatively associated with a design function. Where substantially new or extensively modified requirements are being considered, new design functions may be created. In some cases, entire groups of related requirements may be associated with a new or existing design function as an entity rather than as individual requirements. In addition, the CPCRs which have the potential to impact high-level design are reviewed. Affected design functions are evaluated and modified as required.

Revised estimates for design function resource requirements (memory, CPU, etc.) are calculated based on the proposed modifications. Requirement to design function allocations are adjusted as appropriate to preserve the viability of each design function in terms of its available resources.

The Element group leader reviews, adjusts as appropriate, and approves each modified design function. Element engineers update the requirement to design function matrix in the Element design document to reflect the allocations approved by the Element group leader. The abstract for each impacted design function is then updated or rewritten to reflect the new or modified requirement.

PERFORMER: Elements

SUPPORTING ORGANIZATION: None

APPROVAL REQUIRED: None

APPLICABLE INSTRUCTION: None

Activity: HLD-1.4.1.2

ALLOCATE DESIGN FUNCTIONS TO MODULES

Prior to beginning the actual allocation, Element personnel review the design goals documented in the baseline development folder. These goals, considered in conjunction with performance goals and target system resource issues, are translated into specific

design attributes or architecture such as reduced complexity and increased functional cohesion, and documented with the design goals in the PDD. Appropriate tools and methods for completing the software implementation, consistent with design goals and implementation resource constraints, are identified, selected, and reflected appropriately in the Element development plan.

Each new or modified requirement in each impacted design function is assigned to one of the modules or channel programs associated with the parent design function. In some cases, new modules may be created or existing requirements may be moved from one module to another in performing this function. These trial allocations are modified until the identified goals and constraints are best satisfied and the integrity of the existing design is preserved or improved.

PERFORMER: Elements

SUPPORTING ORGANIZATION: None

APPROVAL REQUIRED: None

APPLICABLE INSTRUCTION: None

Activity: HLD-1.4.1.3

ANALYZE MODULE INTERFACES

Data and control flows necessary to support the trial allocations documented in the previous activity are identified and analyzed. Flows to and from other modules, elements, and external devices must be considered and their impacts assessed. Assessments must include any effects on program characteristics such as cohesion, coupling, complexity, and CPU and memory usage as they pertain to design goals and resource constraints. CPCRs that impact interfaces are included in the analysis. Flows to and from other Elements must be negotiated by personnel from both Elements in order to best satisfy the design goals and resource constraints of all affected Elements.

Alternative allocations are considered in attempts to satisfy defined goals and constraints more effectively. With each alternative, data and control flows must be redefined and assessments must be recalculated and compared to previous alternatives relative to design goals and resource constraints. Details of the physical implementation (e.g., if data exchanges will occur via messages or shared data, or the mechanics of module scheduling) are largely ignored at this time in order to concentrate on issues such as functional cohesion, attaining low-to-moderate complexity, and desirable coupling. Finally, the set of allocations and data and control flows which best satisfies goals and constraints is selected and documented as the module-level functional design.

PERFORMER: Elements

SUPPORTING ORGANIZATION: None

APPROVAL REQUIRED: None

APPLICABLE INSTRUCTION: None

Activity: HLD-1.4.1.4

SELECT ARCHITECTURAL FEATURES

Each data and control flow identified in the functional design is considered in view of the AEGIS architectural features available to support it. Based on design goals and resource constraints, one or more architectural features are tentatively selected for implementing each data and control flow.

As these features are selected, the module-level requirements allocations can be further refined by assigning requirements to individual module entrances. As more and more selections are tentatively made, the criteria for selecting additional features (e.g., entrance priorities and preemption levels, shared data or intermodule messages as communications media, input/output mechanisms, and module scheduling techniques) can be recognized.

When architectural features for implementing all aspects of the functional design have been tentatively selected, the total effect on performance and design goals and constraints is evaluated and timing and resource estimates are updated. All allocations and feature selections are reconsidered for possible improvement in order to satisfy design goals and constraints more effectively. When Element personnel are satisfied that goals and constraints have been adequately satisfied, the current decisions are documented in the high-level design document.

PERFORMER: Elements

SUPPORTING ORGANIZATION: None

APPROVAL REQUIRED: None

APPLICABLE INSTRUCTION: None

Activity: HLD-1.4.1.5

DEVELOP/UPDATE REQUIRED DOCUMENTS

Information from the module design developed in the preceding activity is translated into the proper format and documented in the Element design document. The functional description of all impacted modules is updated to reflect the latest changes at a level of detail sufficient to determine exactly which PPS-level requirements have been allocated to which modules. A depiction of intermodule data and control flow is included. Details on the mechanisms used to effect data transfers and intermodule scheduling are then added. Core and timing estimates are documented in the high-level design document with supporting rationale.

Information on modified global data and new or changed intermodule messages is added to the Element design document. Specifications such as PPSs, PIDSs, and IDSs are updated, as required, to reflect errors or changes discovered during the design process.

The Element development plan is updated to reflect the planning and scheduling details which emerged during the preliminary high-level design effort. The baseline management plan is referenced to ensure that these emerging details do not jeopardize previous commitments to other Elements or baseline management. Finally, the basic agenda and schedule for the CDR are identified and Baseline Management prepares the CDR plan.

PERFORMER:	Elements
SUPPORTING ORGANIZATION:	Documentation Management Baseline Management
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	None

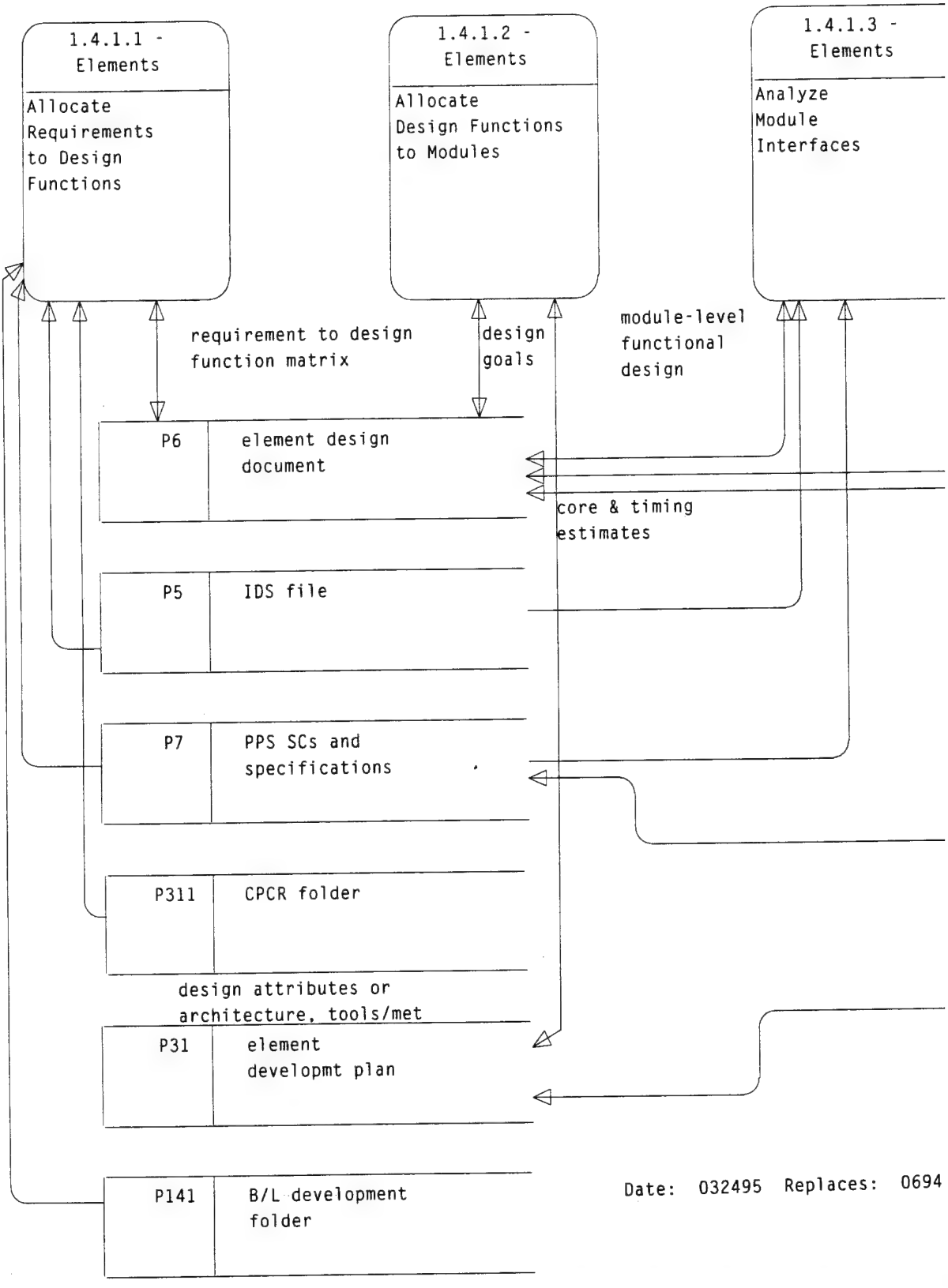
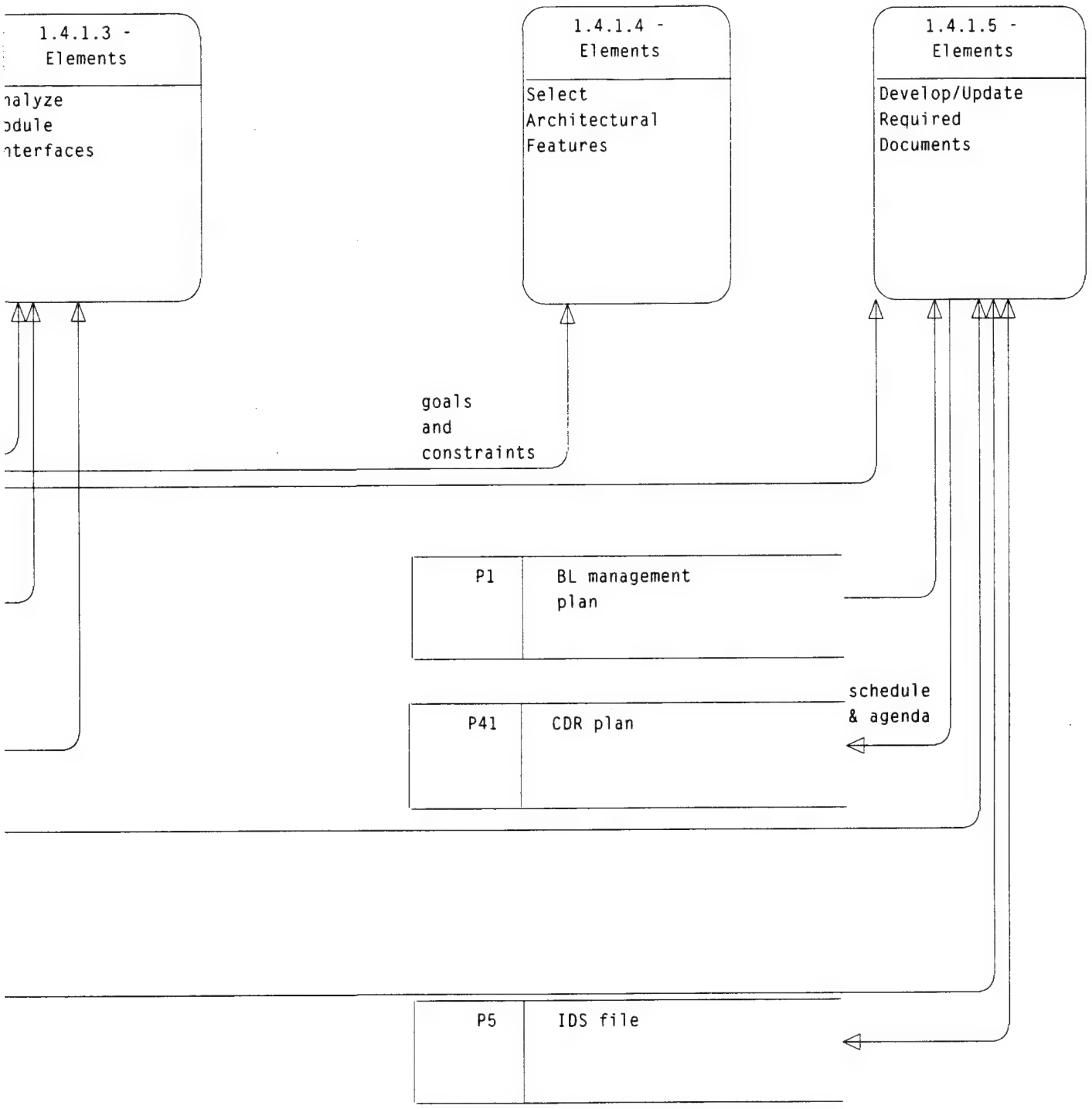


DIAGRAM 1.4.1 PERFORM PRELIMINARY DESIGN IMP PROCESS



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1.4.2 DEVELOP HIGH-LEVEL DESIGN PROCESS

The Develop High-Level Design Process is comprised of three activities as described below. Diagram 1.4.2 (Page II-4-15) is a data flow diagram of the process and its three constituent activities.

Activity: HLD-1.4.2.1

ALLOCATE REQUIREMENTS TO UNITS[1]

After reviewing design goals, resource issues, existing module input/output and unit design, and the requirements allocated to each module, Element personnel further allocate requirements to new or existing units or channel programs. As this allocation occurs, the impact on the design of existing units is assessed in terms of design goals and resource constraints. Particular attention is paid to improving functional cohesion, reducing complexity, and minimizing coupling. This is an iterative process which must be repeated until all design goals have been met and critical resources conserved to the maximum extent practical. Appropriate tools and methods for completing the software implementation are reviewed. The Element development plan is updated, as needed, to reflect changes.

PERFORMER:	Elements
SUPPORTING ORGANIZATION:	None
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	None

Activity: HLD-1.4.2.2

DEFINE UNIT INTERFACE IMPACTS

Using the trial allocation from the preceding activity as a starting point, interunit data and control flows and interchannel program data and control flows are identified. Impacts on other units, data, channel programs, and AEGIS Elements are identified and studied. Each impact is assessed for adverse effects on design characteristics such as cohesion, complexity, coupling, timing, and resource usage. Alternative requirements allocations are tried, flows reidentified, and impacts reassessed until design goals and resource constraints have been best satisfied. At this time, each unit must also be assessed to identify any special problems associated with performing unit test. Units posing special problems may be redesigned or the resources to overcome the special problems must be identified and documented.

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[1] A unit is normally a CMS-2 procedure (or, other programming language equivalent). However, in some cases, a unit may be defined as a small number of procedures due to the way functions are allocated.

When agreement on an approach is reached, new or modified local data requirements are identified and defined, new core and timing estimates are prepared, and the results are documented in the Element design document. CPCR folders are also updated to reflect allocations or design information differing from that previously shown.

PERFORMER:	Elements
SUPPORTING ORGANIZATION:	None
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	None

Activity: HLD-1.4.2.3

REVIEW HIGH-LEVEL DESIGN

The high-level design of all areas of the Element computer program impacted by change is evaluated during formal element-level design reviews. The activity begins by identifying the specific areas of the Element computer program to be covered by each review. Review participants possess a knowledge of the affected areas and an ability to understand and identify improvements to the proposed changes. Materials used in support of reviews are collected from information contained in the PDD, CPCR folders, and working papers of the Element engineers who performed the actual design work.

The high-level design is reworked and redocumented until all issues identified during the reviews are resolved. If rework was significant, follow-on reviews may be required. Each applicable CPCR folder is updated to reflect any rework resulting from review decisions.

PERFORMER:	Elements
SUPPORTING ORGANIZATION:	None
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	None

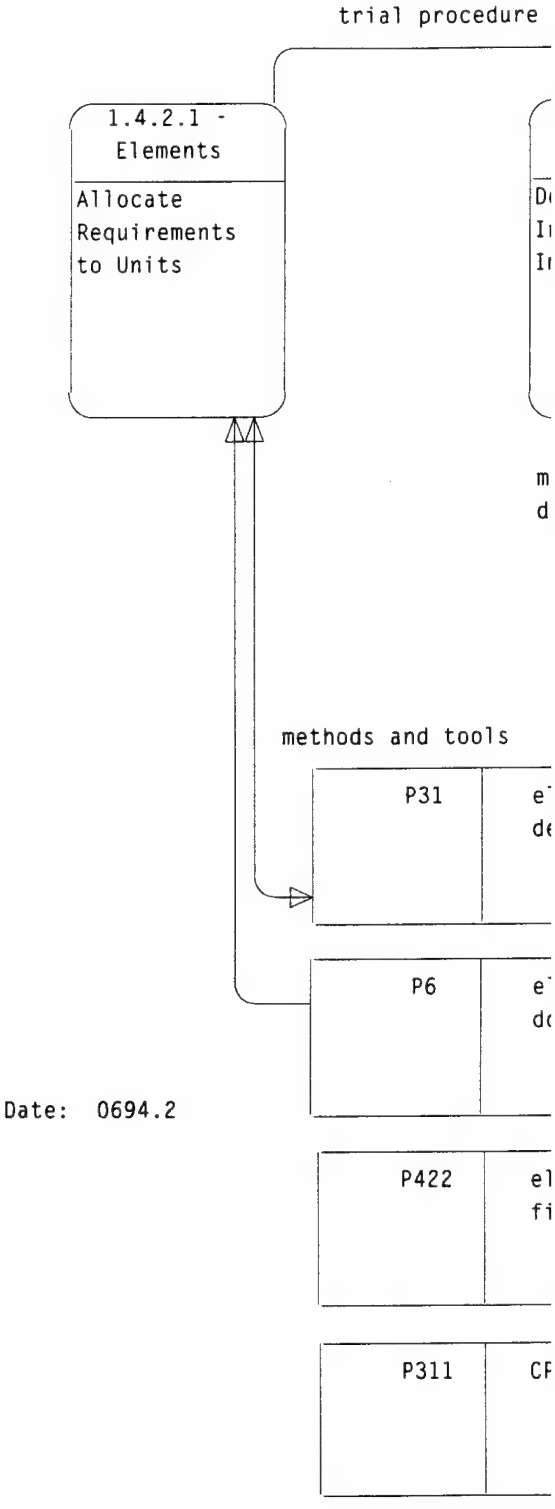
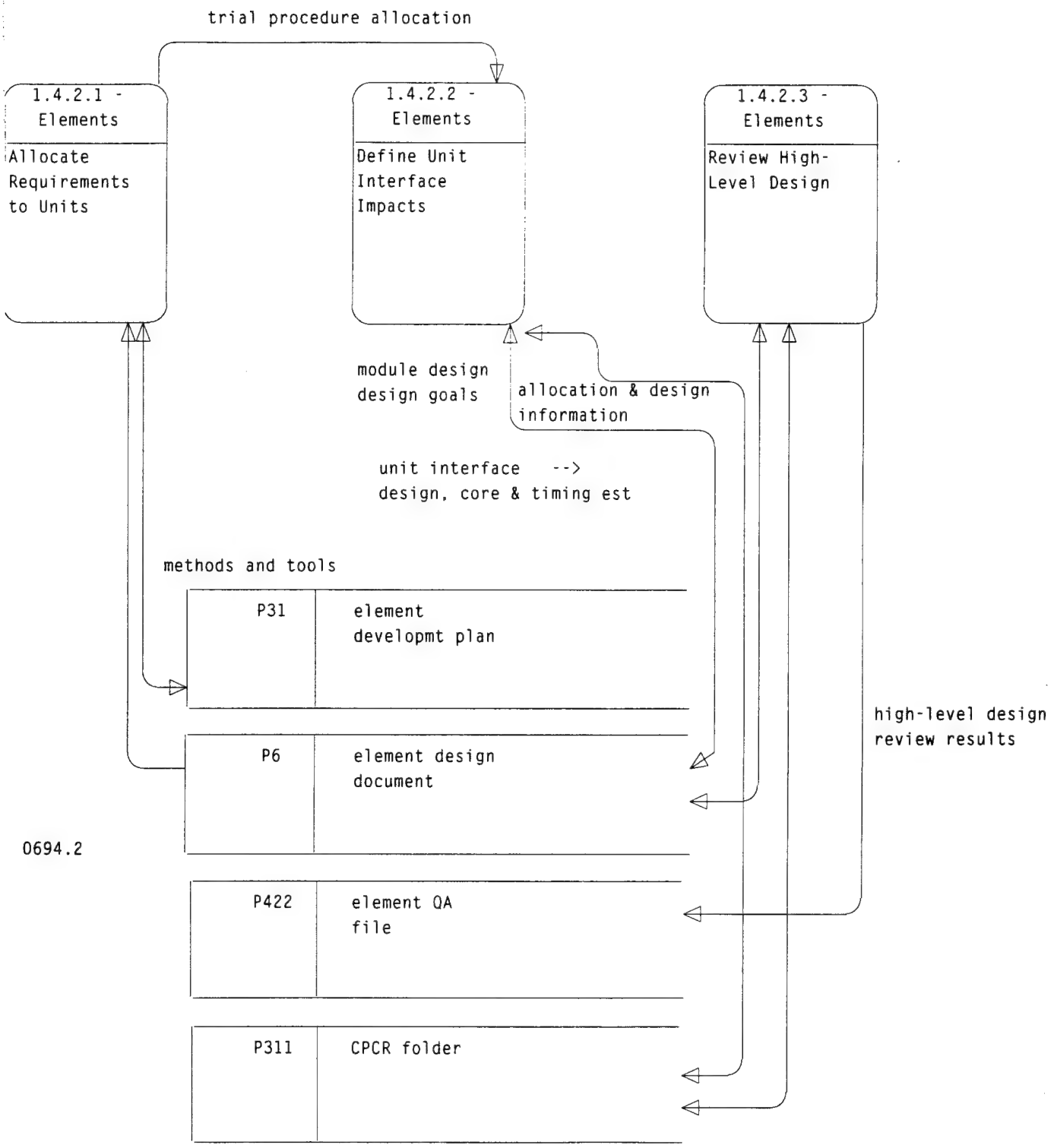


DIAGRAM 1.4.2 DEVELOP HIGH-LEVEL DESIGN PROCESS



:VEL DESIGN PROCESS

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1.4.3 PLAN DEVELOPMENT ACTIVITIES PROCESS

The Plan Development Activities Process is comprised of five activities as described below. Diagram 1.4.3 (Page II-4-21) is a data flow diagram of the process and its five constituent activities.

Activity: HLD-1.4.3.1

DEFINE BUILD CONTENTS

Element planners define a system of builds using an iterative process which begins by examining the entire set of proposed functional and physical changes, including CPCRs, and reviewing the overall goals and plans for the baseline upgrade. Based on this review, groups of functional and physical capabilities which can be implemented together (detail-design, code, unit-test, and integration) are identified. These groups of capabilities are allocated to trial builds.

As the trial build definitions begin to emerge, each is examined for several key issues: the resources required for its development and validation, the complexity of its component parts, the time required for its completion, and the importance of each of its components to the success of the overall baseline upgrade. The trial definitions are then adjusted to achieve each of the following: an adequate degree of resource leveling, a reasonable mixture of complex and simple capabilities in each build, and builds of acceptable duration. Initial definition of site and simulator requirements for each build is specified. Additionally, a determination of the impact of the patch conversions is made.

If the Element's role in the baseline upgrade is small and simple, it is possible for all capabilities to be allocated to a single build.

PERFORMER:	Elements
SUPPORTING ORGANIZATION:	None
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	None

Activity: HLD-1.4.3.2

DEFINE BUILD SCHEDULE

The trial build definitions are placed in a sequence based on any necessary successor/predecessor relationships and interelement needs. Conflicts are resolved by adjusting build content. Once these relationships are satisfied, Element planners adjust the sequence to place high-risk or vitally important builds early in the schedule (without sacrificing any of the essential successor/predecessor relationships). Finally, the content of each build is analyzed to determine the site and labor resources required to perform build integration and test.

PERFORMER:	Elements
SUPPORTING ORGANIZATION:	Baseline Management
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	None

Activity: HLD-1.4.3.3

UPDATE PLANNING DOCUMENTS

The Element development plan is updated to reflect the build definition and schedule prepared during the previous activities and to include schedules for planned usage of sites for required simulators and site availability. In addition, the agenda, participants, and discussion items for the CDR are identified and documented in the Element module of the CDR plan.

PERFORMER:	Elements
SUPPORTING ORGANIZATION:	Baseline Management Facilities Engineering
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	Backfit Design Review Manual

Activity: HLD-1.4.3.4

REVIEW BUILD DEFINITION AND SCHEDULE

Upon agreement on the Element's build definitions and schedules, a meeting is convened by Baseline Management to provide NSWCDD Organizations an opportunity to gain insight into Element plans that may either impact them or that may appear to involve some level of risk that is unaccounted for. The build comments from this meeting are returned to the Elements for resolution. The baseline management plan, including schedule, is updated, as required. Additionally, Element development plans, including schedules, are updated.

PERFORMER:	Baseline Management
SUPPORTING ORGANIZATION:	NSWCDD Organizations
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	None

Activity: HLD-1.4.3.5

PREPARE FOR CODE DEVELOPMENT

The Elements request that QA establish new baseline files. Together with QA, the Elements build a CMS class for the new baseline and transfer the relevant baseline files to the Element user directory (product file). QA verifies program library integrity.

PERFORMER:	Elements
SUPPORTING ORGANIZATION:	NSWCDD Organizations
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	None

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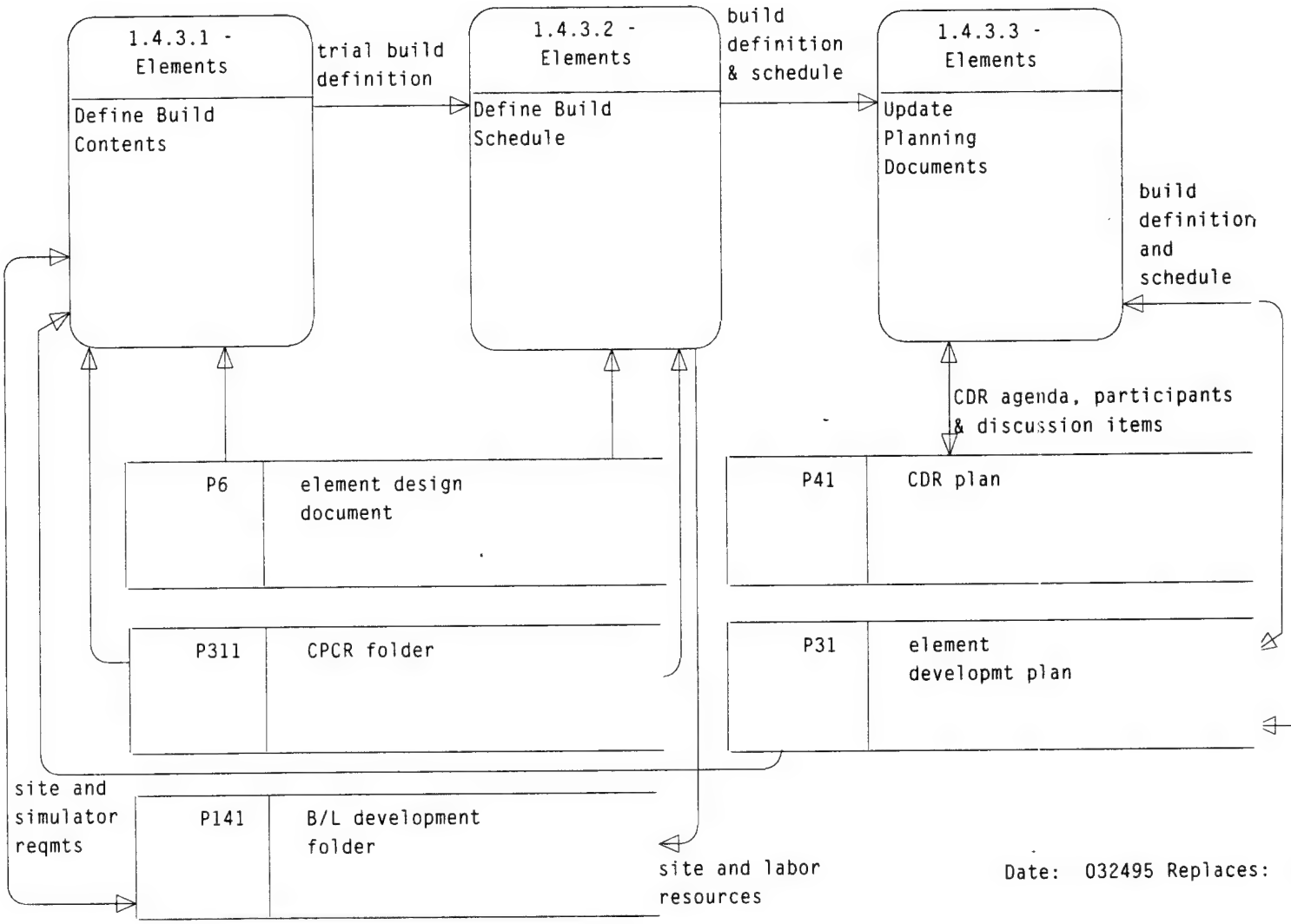

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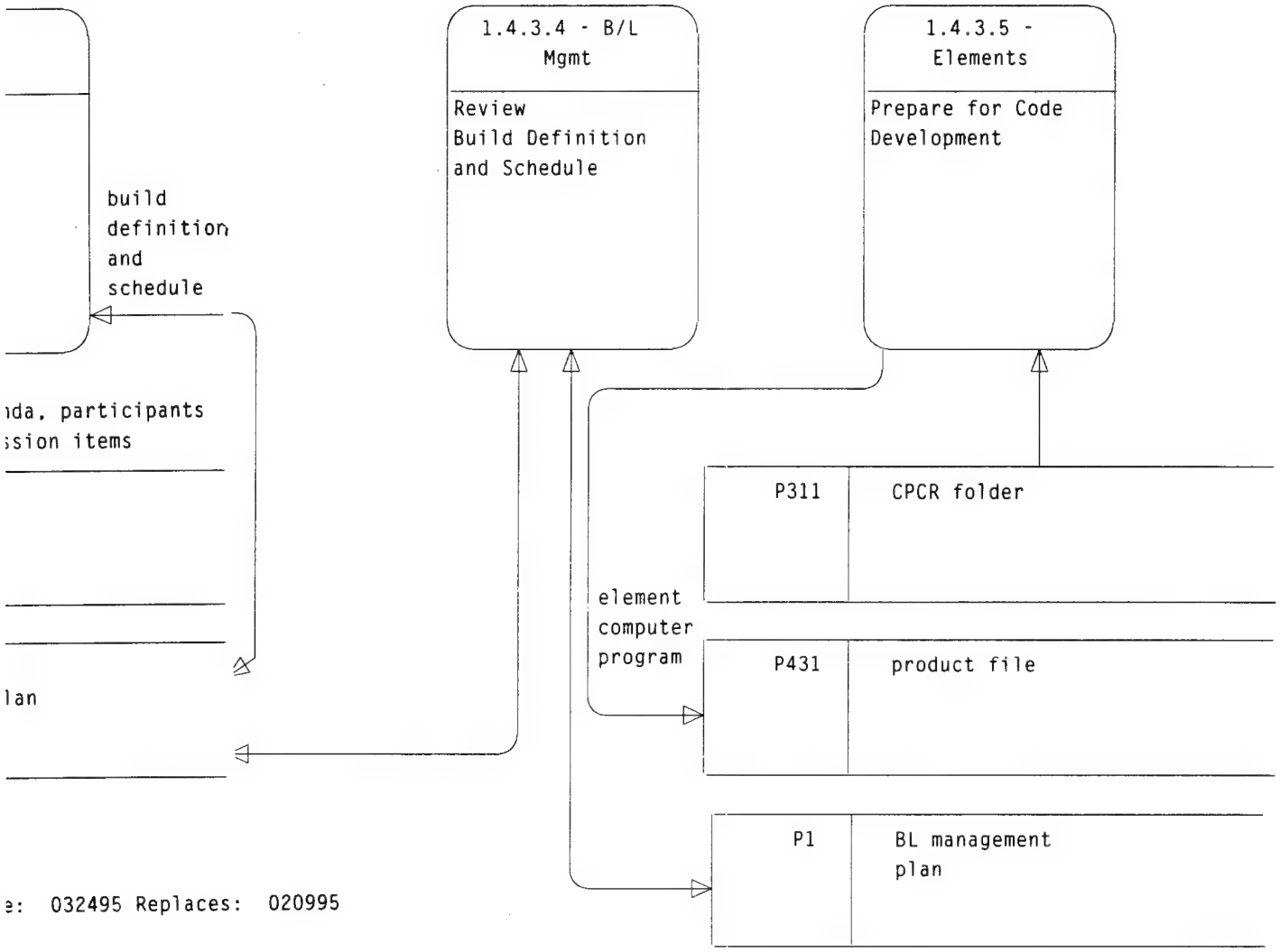
DIAGRAM 1.4.3 PLAN DEVELOPMENT ACTIVITIES PROCES


1.4.3.4 - B/L Mgmt
Review Build Definition and Schedule
1.4.3.5 - Elements
Prepare for Code Development
build definition and schedule
ıda, participants
ssion items
lan
element computer program
P311
CPCR folder
P431
product file
P1
BL management plan
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1.4.4 PLAN TEST ACTIVITIES PROCESS

The Plan Test Activities Process is comprised of three activities as described below. Diagram 1.4.4 (Page II-4-25) is a data flow diagram of the process and its three constituent activities.

Activity: HLD-1.4.4.1

DEFINE REQUIRED ELEMENT TESTS

Element engineers determine requirements to be included in Element-level tests by analyzing test requirements and computer program requirements. Element engineers must consider any system requirements in the system specification documented as having been deferred to Element tests. Element engineers analyze test plans from earlier baselines to determine reusable components as well as to gain insight into structuring tests and allocating test requirements to appropriate tests. Existing tests that may be reused may require modification or adaptation due to requirements or design changes. The result of this activity is a description of each Element test that is required to cover the planned Element changes and indications of which test may be reused without change, reused with modification, or used for insight in creating new tests. Existing tests are reviewed to determine the changes that must be implemented to accommodate planned enhancements or changes to the Element.

PERFORMER:	Elements
SUPPORTING ORGANIZATION:	System Engineering
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	QAI-017

Activity: HLD-1.4.4.2

DEVELOP ELEMENT TEST PLAN

Element personnel define each test identified in the previous activity. The test plan developed includes specific requirements being tested in each test, site utilization information, special test equipment, and special test resources (e.g., data collection, data reduction, operators, aircraft, and simulators). The plan documents assumptions which could affect the validity or execution of the plan. Element personnel identify all test procedures that must be developed, their interdependencies, and their schedule for execution. The plan describes all supporting personnel roles and responsibilities required to conduct the tests, collect required data, reduce and analyze the data, and produce reports documenting the results of the tests.

PERFORMER: Elements

SUPPORTING ORGANIZATION: System Engineering

APPROVAL REQUIRED: None

APPLICABLE INSTRUCTION: QAI-017

Activity: HLD-1.4.4.3

DEVELOP SYSTEM TEST REQUIREMENTS

System requirements are analyzed to determine and document the system level verification requirements. The system requirements are translated into test requirements. Based upon the resulting test requirements, required test support resources are estimated (e.g., personnel, facilities, special equipment, services, and non-AWS system interfaces). Testing issues are assessed and risks are evaluated and documented. The resulting test requirements, resource estimates, and risk data are documented in the baseline development folders.

PERFORMER: System Engineering

SUPPORTING ORGANIZATION: System Test
Facilities Engineering

APPROVAL REQUIRED: None

APPLICABLE INSTRUCTION: None

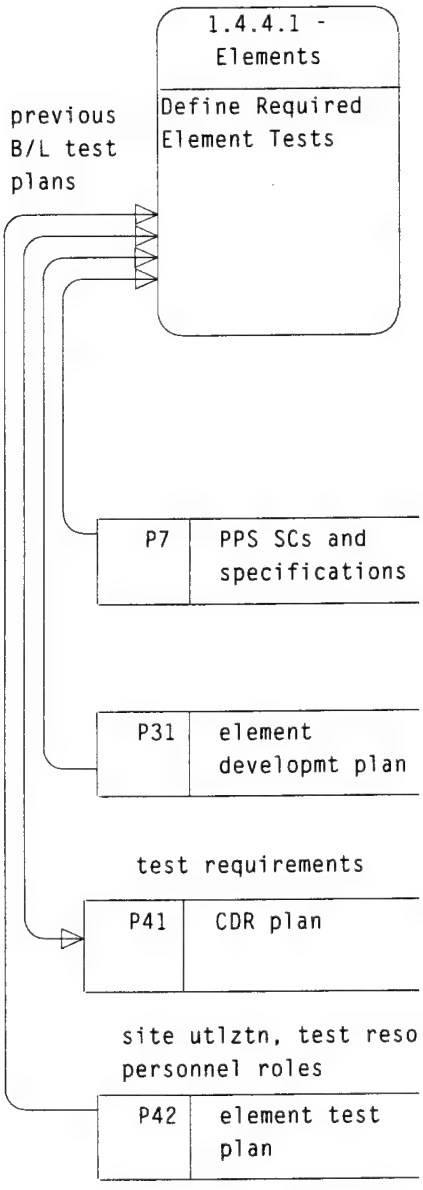
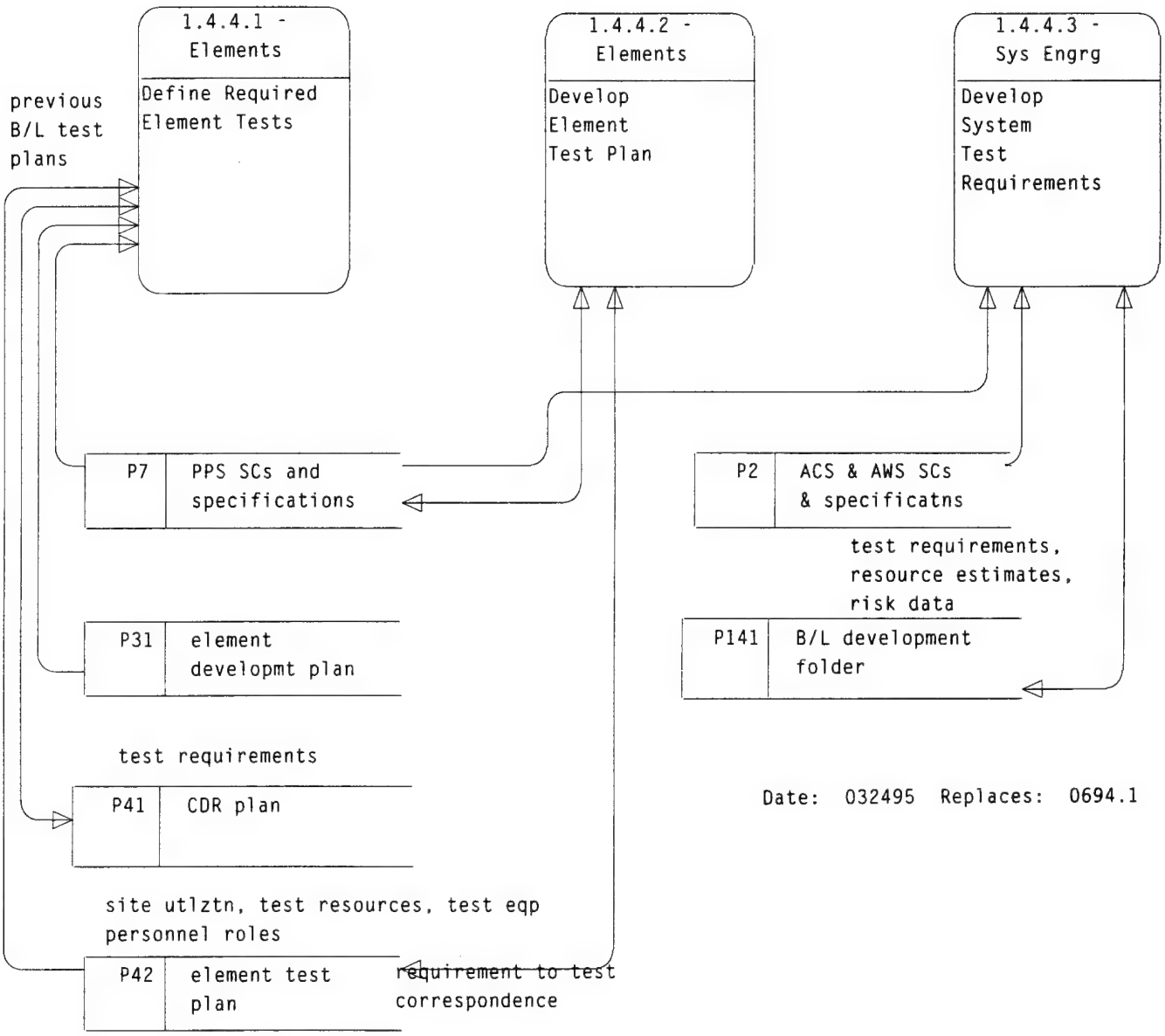


DIAGRAM 1.4.4 PLAN TEST ACTIVITIES PROCESS



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1.4.5 DEVELOP CDR DATA PACKAGE PROCESS

The Develop CDR Data Package Process is comprised of four activities as described below. Diagram 1.4.5 (Page II-4-31) is a data flow diagram of the process and its four constituent activities.

Activity: HLD-1.4.5.1

PREPARE CDR DATA PACKAGE

Element personnel review the requirements for the CDR given in the CDR design review plan. Documentation is prepared or assembled that describes each functional change or CPCR on the change list and shows the traceability of each change back to the PPS. Changes can have an effect on components of the code that are not directly represented in functions documented in the computer program performance specification. For this reason, Element personnel identify all components affected by changes required by the changed computer program requirements (i.e., the domain of change) and document the domain of change for presentation at the CDR. Element personnel assemble interface documentation and subprogram functional logic documentation for all changes. The results of timing and memory utilization analysis are documented. The required tests, as documented in the CDR plan, are evaluated for test change impact. The Elements prepare presentation materials, and all other outputs of this effort are documented in the CDR data package. Documentation Management assembles and distributes the CDR data package within NSWCDD.

PERFORMER:	Elements
SUPPORTING ORGANIZATION:	Documentation Management
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	None

Activity: HLD-1.4.5.2

REVIEW CDR DATA PACKAGE

System Engineering and the Elements meet to review the CDR data package. System Engineering reviews and endorses all Element CDR packages to ensure system requirements are met, Element designs are acceptable, and requisite Element connectivity issues are addressed.

Upon completion of the review of the CDR data package, Element engineers meet to review and respond to the submitted comments and prepare for Element Design Review Team (ERT) review. The CDR data package is updated, and Documentation Management distributes the package to Navy review teams (ERTs and SRT) established by PMS 400.

PERFORMER:	Elements
SUPPORTING ORGANIZATION:	Baseline Management
	System Engineering
	Documentation Management
	AIS
	ATC
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	Backfit Design Review Manual

Activity: HLD-1.4.5.3

REVIEW AND CATEGORIZE CDR DATA PACKAGE COMMENTS

The ERTs are convened by PMS400 Warfare Area Commanders to review the CDR data package. The designated chairman directs the ERT to review and agree to an action category for each comment. The categories are A-D, depending on the difficulty of resolution, per the backfit design review manual. If necessary, the commenting author is requested to provide comment rationale.

The ERT chairman documents outstanding issues, the rationale for the categorization of the comments, and any specific comments deemed necessary to be brought to the attention of the SRT or PMS400B. ERT meetings continue until all comments are reviewed and categorized. Completed ERT categorized comments are forwarded to the SRT. The ERTs also generate memos to the SRT that outline the comment categories and identify outstanding issues.

PERFORMER:	Element Design Review Teams
SUPPORTING ORGANIZATION:	Baseline Management
	Elements
	PHDNSWC
	APL
	Government Electronic Systems
	System Engineering
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	Backfit Design Review Manual

Activity: HLD-1.4.5.4

REVIEW ERT COMMENT CATEGORIES AND RESOLVE PROBLEMS

The SRT is convened to adjudicate the unresolved ERT comments or issues. The chairman directs the SRT to review unresolved comments and agree to any action category changes. Action categories are in accordance with the design review manual.

The SRT chairman documents the rationale for category A comments and any that the SRT deems necessary to bring to the attention of PMS400B at the formal PDR. If necessary, the ERT chairman is requested to provide categorization rationale. Completed SRT categorized comments are forwarded to NSWCDD System Engineering for coordination, and to Baseline Management. Recommended changes to the CDR data package are analyzed for impact. The CDR data package is updated in accordance with Navy review team comments.

PERFORMER:	System Design Review Team
SUPPORTING ORGANIZATION:	System Engineering Elements Baseline Management ST&E
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	Backfit Design Review Manual

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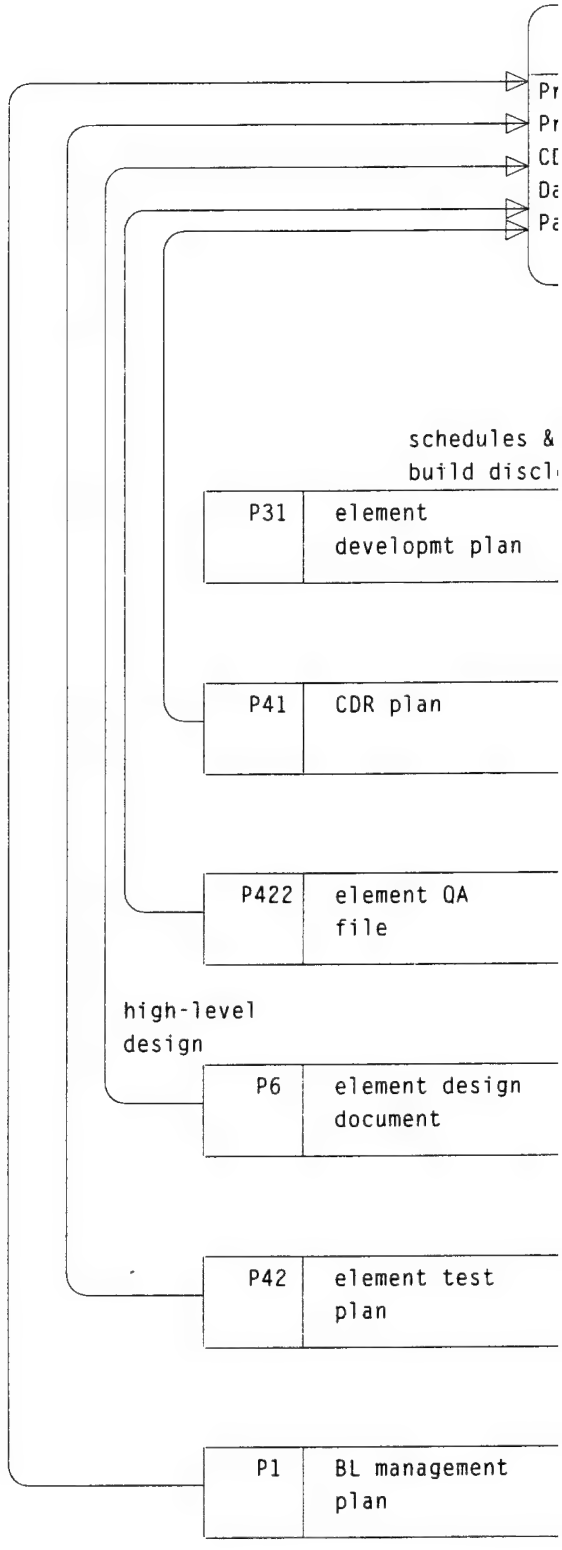
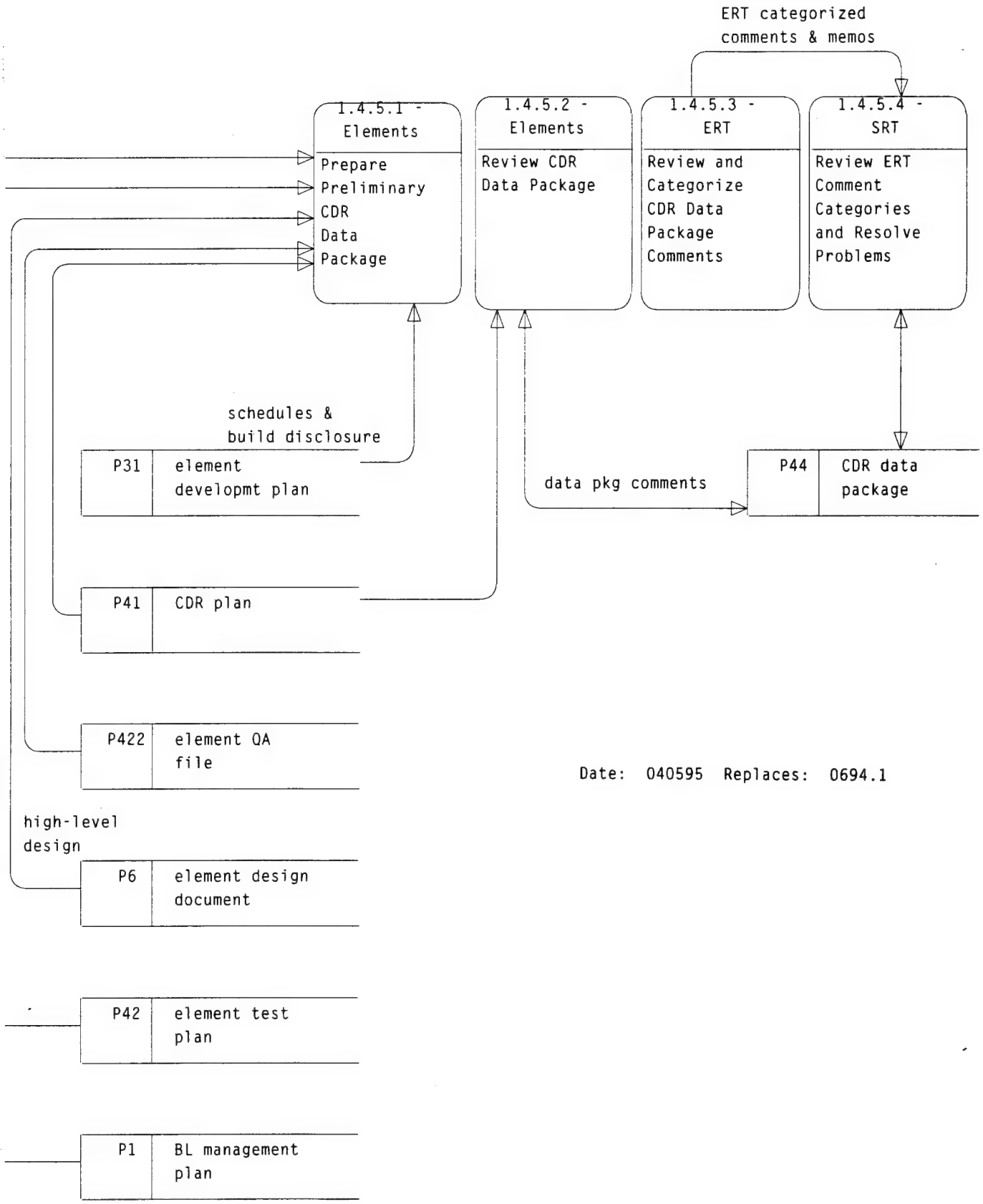


DIAGRAM 1.4.5 DEVELOP CDR DATA PACKAGE PROCESS



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1.4.6 CONDUCT CDR PROCESS

The Conduct CDR Process is comprised of ten activities as described below. Diagram 1.4.6 (Page II-4-39) is a data flow diagram of the process and its ten constituent activities.

Activity: HLD-1.4.6.1

UPDATE ELEMENT CDR PRESENTATION

Element personnel review the updated CDR data package and document perceived risk issues. Element personnel prepare required Element documentation changes including messages and common data definitions. Element personnel update changes in traceability to PPSs and describe any processing that is added or changed. Based upon planned changes, core and timing estimates are developed and impacts are documented. Requirements for facilities, equipment, and simulators to support planned activities are described. The Elements prepare design disclosure information, and all products of this effort are documented in the CDR presentation package.

Post-PDR change descriptions (i.e., equipment changes, interface impacts, and computer program changes), high-level design descriptions, and requirements traceability are supplied by the Elements. Facility/resource availabilities are supplied by Facilities Engineering. System-level descriptions and risk assessments are supplied by System Engineering. The crew training plan is supplied by the AEGIS Training Command. Installation plans, schedules, and action item status are supplied by Baseline Management.

PERFORMER:	AEGIS Organizations
SUPPORTING ORGANIZATION:	None
APPROVAL REQUIRED:	None
APPLICABLE INSTRUCTION:	None

Activity: HLD-1.4.6.2

PREPARE SYSTEM ENGINEERING CDR PRESENTATION

System Engineering reviews the Element design disclosure for all Elements involved in the baseline development effort. System Engineering personnel develop a system-level description of the functional changes to the combat system and weapon system (including ORDALTs and firmware changes). The description may involve functional flow diagrams, data flow diagrams, sequence and timing diagrams, configuration description drawings, or other description forms, as appropriate, for conveying the functional capability and system-level significance of planned changes. System-level technical risk is updated and described based on design analysis activities.

PERFORMER: System Engineering

SUPPORTING ORGANIZATION: Elements
PMS400G
PHDNSWC

APPROVAL REQUIRED: None

APPLICABLE INSTRUCTION: None

Activity: HLD-1.4.6.3

PREPARE FACILITIES ENGINEERING CDR PRESENTATION

Facilities Engineering coordinates with the Elements and ST&E to identify the required facilities. Facilities Engineering performs necessary planning and coordination needed to assure commitment of required facilities, equipment, and services or to obtain acceptable accommodations where requirements cannot be achieved. Facilities Engineering prepares the facility and resource availability part of the CDR presentation package.

PERFORMER: Facilities Engineering

SUPPORTING ORGANIZATION: Elements

APPROVAL REQUIRED: None

APPLICABLE INSTRUCTION: None

Activity: HLD-1.4.6.4

REVIEW TECHNICAL CDR PRESENTATION MATERIAL

System Engineering reviews the Element design disclosure reflected in the CDR data package for all Elements involved in the baseline development. System Engineering is responsible for ensuring that all design disclosure presentations are technically accurate and harmonious and that all design changes presented are compatible and complete. System Engineering informally discusses and resolves recognized problems or issues with affected Elements.

PERFORMER: System Engineering

SUPPORTING ORGANIZATION: Elements

APPROVAL REQUIRED: None

APPLICABLE INSTRUCTION: None

Activity: HLD-1.4.6.5

PREPARE BASELINE MANAGEMENT CDR PRESENTATION

Baseline Management prepares an updated schedule and documents action item status. Baseline priorities are determined and documented along with recognized risk issues. Non-MK 7 impacts are documented including schedule and synchronization problems. The complete CDR presentation package, including the technical parts supplied by System Engineering and the Elements, is discussed with the NSWCDD AEGIS Program Office for authorization to proceed to CDR with the CDR presentation package.

PERFORMER: Baseline Management

SUPPORTING ORGANIZATION: System Engineering
Elements
Non-MK 7

APPROVAL REQUIRED: Program Office

APPLICABLE INSTRUCTION: None

Activity: HLD-1.4.6.6

CONDUCT CDR MEETING

Baseline Management facilitates the CDR meeting. Each organization presents its approved briefing materials and makes supporting technical and management design disclosure data available, as required. A facilities report is presented to confirm facility availability and commitment. Element and System Engineering personnel assigned to Navy review teams provide CDR presentation support, as required, in terms of their particular assignments. Baseline Management provides interface, as required, to permit ATC training data for issues arising subsequent to PDR to be included in the CDR program. Minutes are recorded and action item logs are maintained and reviewed prior to concluding the CDR. Upon completion of CDR presentations, an executive panel deliberates readiness to proceed to the Build Implementation Phase and detailed design. CDR meeting minutes are distributed to attendees.

PERFORMER: Baseline Management

SUPPORTING ORGANIZATION: System Engineering
NSWCDD Organizations
ATC

APPROVAL REQUIRED: PMS400

APPLICABLE INSTRUCTION: None

Activity: HLD-1.4.6.7

UPDATE TECHNICAL DOCUMENTATION PER CDR DIRECTION

CDR results are used to update the respective baseline development folders. Any affected SCs and ICRs are updated and distributed. Design document change requests (DDCRs) are prepared to identify the required updates to design documentation.

PERFORMER: Elements
SUPPORTING ORGANIZATION: Baseline Management
System Engineering
Documentation Management
APPROVAL REQUIRED: None
APPLICABLE INSTRUCTION: None

Activity: HLD-1.4.6.8

REVIEW AND APPROVE DDCRs

DDCRs are reviewed within the Element group. The Element ECCB monitors the review process and gives final approval for implementation of DDCRs into the Element design documents. The status of DDCRs is tracked with ACCESS.

PERFORMER: Elements

SUPPORTING ORGANIZATION: CM
CRB CM
Documentation Management

APPROVAL REQUIRED: Element ECCB

APPLICABLE INSTRUCTION: None

Activity: HLD-1.4.6.9

UPDATE MANAGEMENT PLANS

Baseline Management updates the baseline management plan, as required by CDR decisions. Elements update the Element development plan in accordance with commitments negotiated with Baseline Management, and as required by CDR decisions.

PERFORMER:	Baseline Management
SUPPORTING ORGANIZATION:	Elements Documentation Management
APPROVAL REQUIRED:	Branch Head
APPLICABLE INSTRUCTION:	None

Activity: HLD-1.4.6.10

UPDATE ENGINEERING DOCUMENTATION

Documentation Management prepares the Element design document in accordance with approved DDCRs. Documentation Management, in consultation with the affected Elements, determines whether the update will be performed using change pages or whether a complete design document re-issue will be performed. Documentation Management publishes and distributes the updated Element design document.

PERFORMER:	Documentation Management
SUPPORTING ORGANIZATION:	Elements Baseline Management
APPROVAL REQUIRED:	Branch Head
APPLICABLE INSTRUCTION:	None

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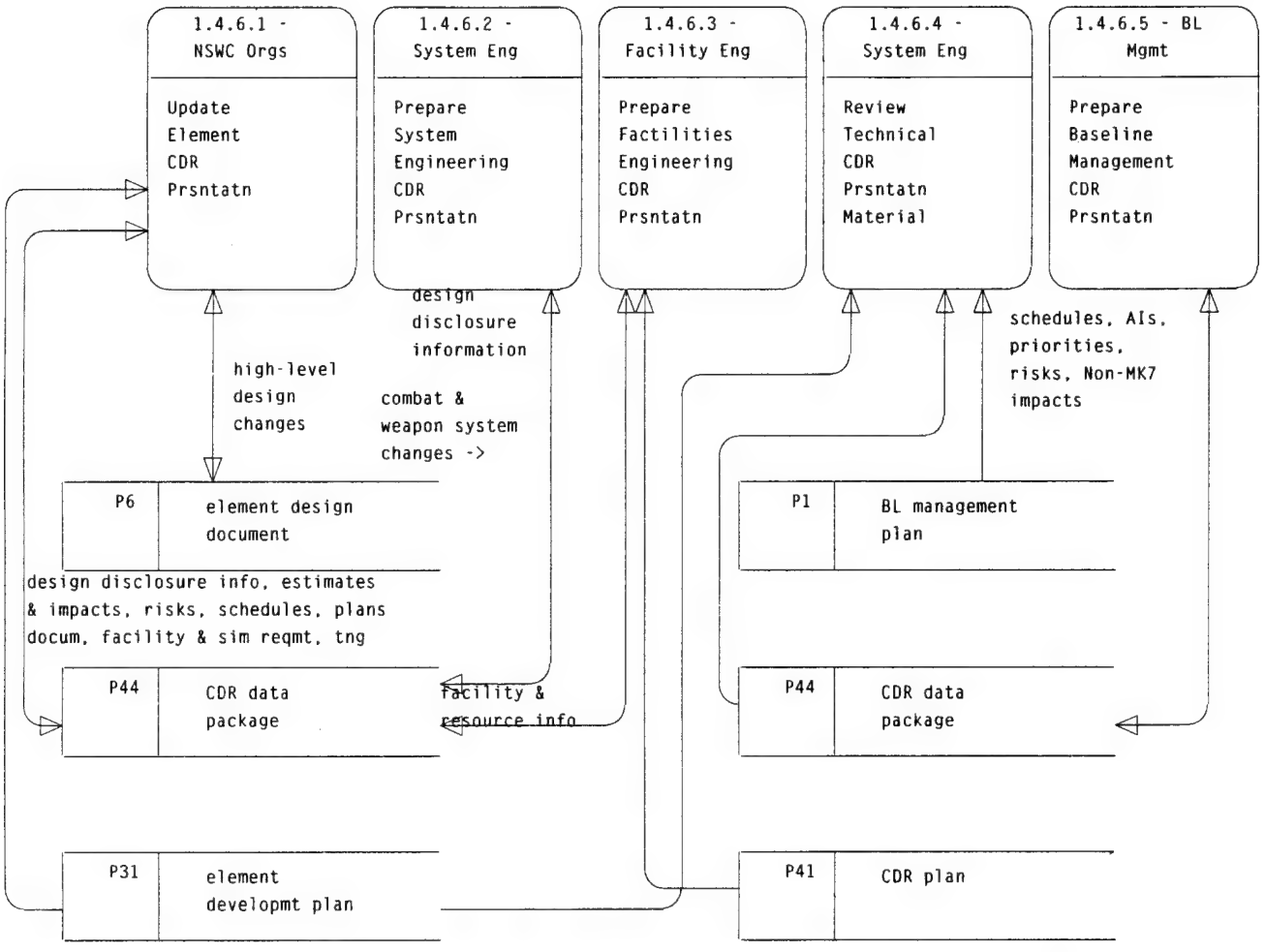
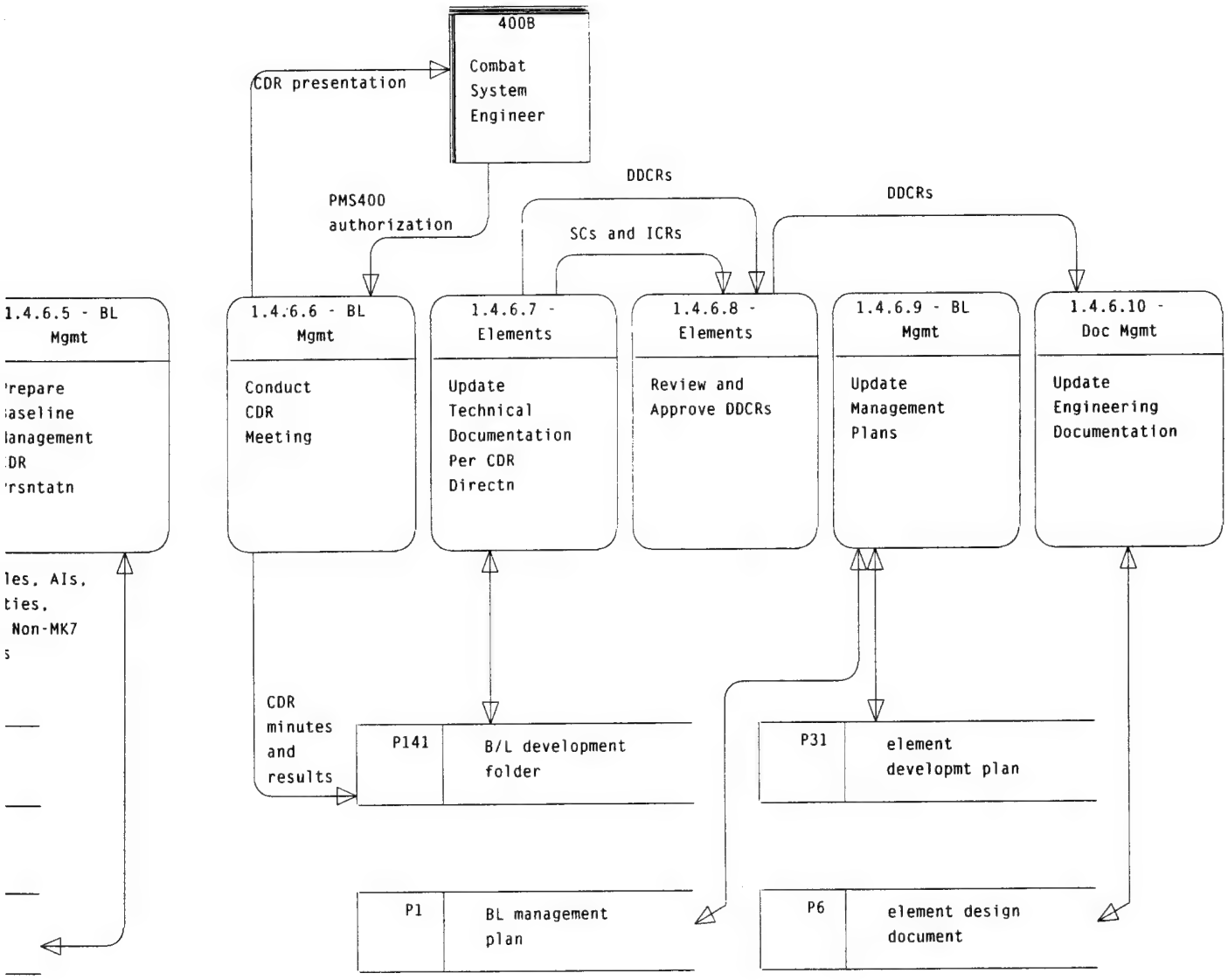


DIAGRAM 1.4.6. CONDUCT CDR PROCESS



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5. BUILD IMPLEMENTATION PHASE

The Build Implementation Phase consists of a sequence of one or more builds during which each unit identified during the High-Level Design Phase is developed and checked out. Independent of these builds, support tools and the System Test Plan are created or updated as appropriate.

The first step during each build is to review existing plans and add the details necessary to govern the conduct of the current build. Additionally, each CPCR identified for inclusion in a particular build is examined to determine which of two alternative processes will be used for its implementation.

Small and simple CPCRs may be implemented using a three-step process consisting of Design Review and Modification, Code Development and Checkout, and Impact Testing. Larger CPCRs must go through the more formal process used for functional upgrades consisting of Planning Unit Test, Developing Detailed Design, Developing Unit Test Procedures, and Performing Code and Unit Test. The respective process to be employed for each CPCR is identified in the Element development plan which, upon approval, serves as the basis for subsequent QA activities.

Within each build, different units scheduled for implementation may be at different steps in the build process at the same time. For example, while a relatively small unit may have progressed to the unit test step, a much larger unit may still be in the detailed design step.

As units complete unit testing, they are packaged with previously completed units in a load file and executed with the rest of the Element and other Elements or simulators. This results in a gradual integration of all units planned for development into the build and ultimately with the rest of the system.

As each build comes to a close, all completed units are executed in a common environment to ensure that no recently integrated unit has had an adverse effect on previously tested code. At the conclusion of each build, a Build Implementation Review (BIR) is conducted where the results of all build activities are discussed. Special emphasis is placed on any facts or plans disclosed at prior reviews which might be invalidated by the recently completed build. The BIR for the final build summarizes the disclosures of the previous BIRs and serves as the control event which signals the completion of the Build Implementation Phase. The BIR is documented, action items are assigned, and the action items are tracked to closure. The report documenting the final BIR is the control event that ensures completeness of all code and unit testing activities for all builds and serves as a status report to the Baseline Manager.

Primary Activities, Products, and Control Events

Detailed descriptions of the activities in this phase are in preparation.

Activities

High-level design check-out
Examination of CPCRs
Design review
Development of unit test procedures
Coding and unit testing
Load file integration
Preparation for Build Implementation Review
Element and system test planning

Products

Unit Design Document
Unit Test Procedures
System Test Plan
Element Test Procedures
Unit Test Reports
Unit Test Limitations Reports
Element QA Reports
Executable Computer Programs
Source Code

Control Event: Build Implementation Reviews (BIRs)

Purpose: Several BIRs are conducted to review the results of build activities. For the final build, the BIR is held to ensure system design requirements are met, efficient program design has been achieved, coding and unit test activities are complete, and the organization is ready to begin integration and formal element testing.

Preparer: Element Group Leaders

Coordinator: Element Group Leaders

Reviewer: Element QA

Authorizing Agent: Element Branch Heads

6. ELEMENT TEST PHASE

In this phase, each Element is responsible for performing PIDS change validation, computer program performance change validation, element integration, regression testing, stress testing, and Element interface testing.

To ensure completeness of Element test preparation, Baseline Management reviews Element (including Systems Simulation) readiness for test planning and procedure documentation and readiness of the test environment. Baseline Management is responsible for designating an Element Test Disclosure Review (ETDR) panel and conducting an ETDR prior to authorization to proceed to test conduct.

Each Element produces (from source code, patches, and template files) an Element load file to be used in testing in Element and System environments. Multi-Element Integration and Test (MEIT) activities continue in an iterative manner with updated load files. This effort continues until a load file has completed unit, functional, interface, and CPCR verification. The source code is then frozen and an Element/QA-controlled load file is created.

User documentation (operations manuals etc.) and System Test Procedures are prepared.

Formal Element test is conducted by running the test procedures and documenting problems via CPCRs, as they are uncovered. If high-priority problems are found during this phase, they are patched, independently verified, and the test procedure that uncovered the problem is rerun in its entirety. Once all high-priority problems are resolved and all Element tests are run satisfactorily, the Element Leader determines that Element testing is complete. Element Test Reports, Element Test Limitations Reports, and System QA Reports are generated. At this point, the Element files are passed to QA for review and audit.

To ensure Element development is sufficiently complete and the computer programs are ready for System Test, Baseline Management designates an Element Readiness Review (ERR) panel and conducts an ERR prior to authorizing commencement of System Test.

Primary Activities, Products, and Control Events

Detailed descriptions of the activities in this phase are in preparation.

Control Event: Element Test Disclosure Review

Purpose: To ensure completeness of Element-level test planning, test design, and test procedure documentation
To ensure readiness of Elements to start the Element Test Phase
To ensure readiness of ACSIS to support Element Test

Preparer:	Elements
Coordinator:	Baseline Management
Reviewer:	Elements, ETDR Panel
Responsible Agent:	Element Branch Heads
Authorizing Agent:	Baseline Management

Activities

MEIT planning, coordination, and testing
Element stress testing
Element regression testing
Validation of PIDS SCs, PPS SCs, IDS ICRs, and CPCRs
Initiation of source and patch project change control
QA audits
Preparation of System Test Disclosure Review (STDR) package
FDF update

Products

System Test Procedures
Element Test Reports
Element Test Limitations Report
System QA Reports
User Documentation
System Test Procedures
Biweekly Element CPCR Report

Control Event: Element Readiness Review (ERR)

Purpose: To ensure that Element development is sufficiently complete and the computer programs are ready for the System Test Phase.

Preparer:	Elements
Coordinator:	Baseline Management
Reviewer:	ERR Panel
Responsible Agent:	Element Branch Heads
Authorizing Agent:	Baseline Management

7. SYSTEM TEST PHASE

In the System Test Phase, Element-certified AWS and non-Mk 7 computer programs performing together as a combat system are evaluated. Testing includes integration of the computer programs with combat system equipment at a land-based test site that closely replicates the shipboard configuration.

The objectives of System Test are to ensure that the programs (1) perform required ship missions in accordance with specifications, (2) do not regress from the capability of the programs being replaced, and (3) are stable in use.

The System Test Disclosure Review (STDR) assures the completeness of system-level test planning, test design, and test procedure documentation and verifies readiness to begin system test. Baseline Management designates an STDR panel and coordinates preparation for and conduct of the STDR. Upon the receipt of STDR approval, system disk packs are created or updated to support initial ST&I. Problems encountered during testing are documented in CPCRs or ST&I-controlled test observation reports (TORs).

Final System Test is conducted with trial QA disk packs created by Computer Program Management (CPM). The results of final System Test are documented by ST&I in a System Test Report and a concerns list and by QA in a System QA Report. A Documentation Status Report and an Installation Plan are generated.

Under the direction of the Program Office, Baseline Management convenes a Computer Program Certification panel (CPCP) to certify readiness of the computer programs and documentation for installation in the fleet and at shore installations. Presentations and recommendations to the CPCP for ship installation include but are not limited to key Elements, ST&I, QA, and Baseline Management.

Primary Activities, Products, and Control Events

Detailed descriptions of the activities in this phase are in preparation.

Control Event: System Test Disclosure Review

Purpose: To ensure completeness of system-level test planning, system test design, and test procedure documentation
To ensure system test readiness to begin the System Test Phase

Preparer: ST&I

Coordinator: Baseline Management

Reviewer: STDR Panel

Responsible Agent: ST&I Branch Head

Authorizing Agent: Baseline Management

Activities

AWS SCs validation
ICRs validation
Regression testing
Stress testing
ACS integration testing
Test analysis
QA audits
Preparation of CPCP packages
TOR evaluation and analysis

Products

System Test Report
TORs
Concerns List
System QA Report
Installation Plan
Documentation Status Report
Biweekly CPCR Report

Control Event: Computer Program Certification Panel

Purpose: To certify readiness of the computer programs and documentation for installation in the fleet
To generate certification letter for new baseline

Preparer: Baseline Management, QA, ST&I, and Elements

Coordinator: Baseline Management

Reviewer: CPCP

Authorizing Agent: Program Office

8. OPERATION PHASE

The Operation Phase begins with the installation of computer programs and documentation on AEGIS ships and at AEGIS sites. It continues with engineering support of ships for scheduled trials, ship and fleet exercises, combat system experiments, and special PMS400 requests, as well as ship problem report review and operational process and product assessment measures.

Fleet Support is responsible for coordinating all installation activities with NSWCDD Organizations and preparing installation plans. Schedules are developed based on ship availability schedules and the scope of work to be performed. Fleet Support also coordinates activities with PHDNSWC, the ACS ISEA.

Shipboard installation media and documentation are developed to support installation. CM master packs (at-sea-configured ship packs) are created by CPM from direction received from the Elements. The Elements identify files to be removed from the master pack and tapes to be used for restoring new files to the master pack. Load files are taken only from QA tapes. Delivery packs are cloned from the primary CM master pack. A set of in-port-configured tactical packs is created by cloning the CM master pack onto the primary in-port pack and making the appropriate in-port changes.

NSWCDD receives the computer program media and documentation from each non-Mk 7 In-Service Engineering Agent. Contents of each package are controlled and identified by transmittal letters.

An Installation Team led by Fleet Support and consisting of NSWCDD personnel from Fleet Support, Elements, ST&I, QA, CPM, CM, and Documentation Management installs and tests the ACS computer programs and resolves all operational problems associated with the installation. The Installation Team also indoctrinates the ship's crew and provides any required updates to ship documentation.

NSWCDD Organizations direct or support all subsequent ACS performance evaluations and improvement efforts.

Primary Activities, Products, and Control Events

Detailed descriptions of the activities in this phase are in preparation.

Activities

Generation of Delivery Media
CM Audits

Installation of AWS computer programs
Problem report investigation and impact assessment
Problem report resolution assessment
User analysis and training support
QA process analysis
Crew briefing and indoctrination
Delivery of non-Mk 7 computer programs
Documentation loadout
Installation review with ship (CO, Combat System Officer, System Test Officer)

Products

Installation Media (including delivery tapes, disk packs, and cassettes)
Installation Documentation (including tape and disk pack listings, delivery description document, load program description, data recording/data reduction manual, computer program description document, ABAM, users manuals, and specifications)
Installation Report
Ship Test Report
System QA Process Report
Validated Problem Reports
Crew Indoctrination Package

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N86 (Parker)	1
N87	2
N87 (Hubbard)	1
N90	1
N91	5
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N91 (Haney)	1
N91 (Hartwig)	1
N92	3
N92 (Bucholdt)	1
N92 (Cullen)	1
N92 (Hart)	1